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A McGRAW-HILL PUBLICATION

THE SIXTY-FIRST

ANNUAL REVIEW

AND

STATISTICAL NUMBER

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February 8, 1930

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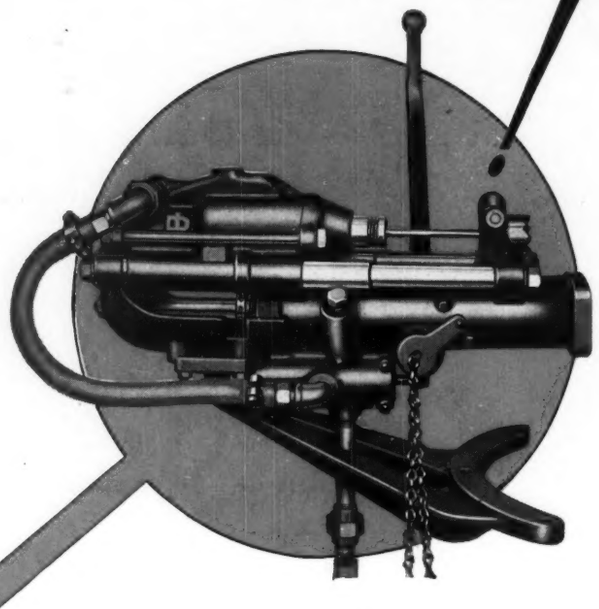

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The SIXTY-FIRST ANNUAL REVIEW

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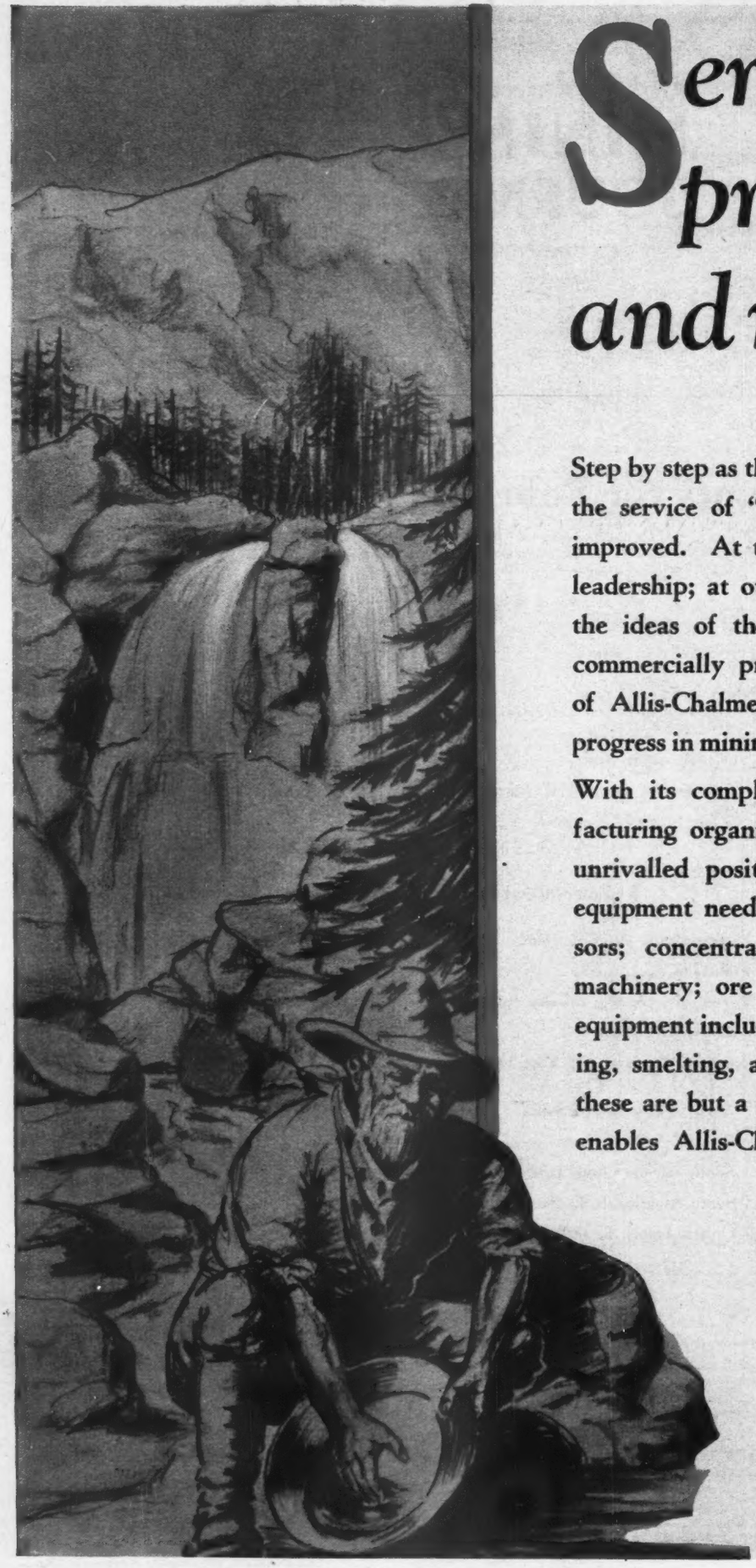

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New York, February 8, 1930

Is Metal Mining Declining in the United States?

IN COMPARATIVELY recent times, the percentage of the total world production of non-ferrous metals contributed by mines in the United States has shown a tendency to decline. This has led over-hasty prognosticators to assert that the industry in this country has passed its peak. A careful survey of the actual situation should dispel any such fear.

As the copper producers in the United States, with their large excess capacities, were the first to reap benefit from the increased prices and production of the winter of 1928-29, so today they are bearing the brunt of a curtailment that has as its object the stabilization of copper prices at levels commensurate with investment in the past and responsibilities in the future. Although the copper mines in this country probably never again will produce one-half of the world's output of new red metal, the reserves of ore are so large, the personnel and the facilities for technical and industrial research are so well organized, as to insure continued leadership, if not statistical predominance, in the copper industry.

The application of selective flotation to complex ores, an increased output of electrolytic zinc, static consumptive requirements, and internal dissension among producing groups have resulted in temporary chaos for the zinc industry. The situation has been aggravated by the obsolete economics to which the Sherman law commands adherence. Unable to combine with competitors in other parts of the country for the common good, zinc producers in the Tri-State district, with properties that are fully developed and equipped, must shut down while new mines enter production in the Northwest and East. Co-operation to stimulate demand, the only co-operation deemed innocuous by law, offers probably the best solution.

Lead producers face the future with more certainty. Output from Utah mines is declining, with low silver prices an adverse influence, but the vigorous exploration being undertaken by the smelting companies gives assurance that the resources of Park City, Tintic, and Bingham will be thoroughly tested. Despite a price that affords only a fair return to the miner, the Cœur d'Alene and southeastern Missouri camps continue to produce lead in as large quantities as ever.

Mining for gold alone in the United States is becoming less and less profitable. Producers are finding the gap between static incomes and increasing costs impossible to bridge. The removal of existing restrictions on placer mining, and large-scale and simple treatment methods for low-grade ore, following the illustrious examples of Homestake and Alaska Juneau, may yet save the day.

The proposed tariff on imported silver, if approved, can be of little or no benefit so long as domestic mines continue to produce more than is consumed in this country. Low prices notwithstanding, the silver output of the United States will probably rise or fall concurrently with production of the base metals.

Quicksilver and manganese are the two minor metals noticeably in the ascendent, although molybdenum is also prospering. Three new manganese plants are in operation, and production is rising steadily, as maintenance of the tariff seems assured.

Since the war the mining of new mineral deposits has made more rapid progress in other countries than here. In spite of a greater output, the percentage of total world production of the non-ferrous metals originating in this country decreased steadily until 1929, when the United States actually increased its share of the world's output of copper, lead, zinc, and silver. Possibly this sudden break in the trend may prove to have been only temporary and of no particular significance. Metal mining in the United States is not declining, however. It is not standing still. It is progressing. Its future success depends largely on the degree to which intensive technical research is followed by the collection and co-ordination of statistics and the statement of facts, accompanied by aggressive and co-operative sales promotion campaigns.

World Production of the Principal Non-Ferrous Metals—1925-1929

Except where otherwise indicated, the figures in the following tables are those compiled by the American Bureau of Metal Statistics.

COPPER — SHORT TONS

Country	1925	1926	1927	1928	1929
United States	854,000	878,000	847,419	935,199	1,179,269
Mexico	59,123	62,303	63,760	72,579	63,678
Canada	56,239	64,124	70,698	96,634	79,919
Chile and Peru	252,785	271,342	316,937	377,379	392,795
Japan	73,289	74,256	73,381	72,796	82,281
Australia	13,578	11,244	12,800	12,846	12,980
Europe	131,896	133,271	139,131	138,489	146,500
Africa	118,670	108,010	123,470	141,131	142,599
Elsewhere	30,137	31,643	34,047	36,378	36,000
World total	**1,589,717**	**1,634,193**	**1,681,643**	**1,883,431**	**2,136,021**

For the years 1925 to 1928, inclusive, these statistics are based on blister copper, referred to countries wherein ore originated. The statistics for 1929 are based on blister copper production as reported by smelters, without segregation according to countries of origin of the ore.

ZINC — SHORT TONS

Country	1925	1926	1927	1928	1929
United States	590,928	638,533	613,548	619,595	628,062
Canada	38,481	61,727	73,528	81,765	86,049
Mexico	1,406	6,550	7,089	12,368	23,151
Belgium	188,339	208,078	219,457	230,689	220,315
France	74,693	80,969	92,161	106,783	100,983
Germany	64,620	75,361	92,706	108,136	116,114
Great Britain	42,726	20,148	46,893	62,043	65,294
Netherlands	23,277	27,333	28,955	29,635	28,341
Poland	126,038	136,393	165,755	178,524	195,020
Spain	16,669	17,707	18,346	14,931	13,031
Australia	51,280	52,942	54,438	55,010	58,173
Rhodesia	.....	.....	.....	10,730	13,577
Elsewhere	47,257	47,471	50,860	66,369	63,500
World total	**1,265,714**	**1,373,212**	**1,463,736**	**1,576,578**	**1,611,610**

These statistics apply to slab zinc produced in the several countries, unallocated according to the origin of the ore. Zinc dust is included in the 1929 figures for Germany and Poland; this amounts to about 400 tons per month for Germany and 700 tons for Poland. Up to the last quarter of 1929, slab zinc produced in the United States from Mexican ore was included in the production of the United States. Beginning with the last quarter of 1929, this output has been separated and included in the production of Mexico.

LEAD — SHORT TONS

Country	1925	1926	1927	1928	1929
United States	662,500	696,000	673,000	649,800	692,233
Canada	126,994	141,386	155,845	170,324	158,789
Mexico	205,159	220,879	274,025	260,675	274,418
Peru	(*a*)	(*a*)	3,601	16,208	19,898
Germany	77,712	84,436	92,593	95,900	121,872
Italy	26,979	26,003	26,206	23,435	24,869
Upper Silesia	30,146	30,648	31,839	39,953	37,766
Spain and Tunis	167,408	182,732	173,849	155,059	115,100
Australia	165,634	170,412	184,710	182,808	194,048
Burma	52,945	60,849	73,883	87,790	89,972
Rhodesia	3,674	4,292	6,561	5,230	1,831
Elsewhere	150,703	152,641	161,828	159,468	201,000
World total	**1,669,854**	**1,770,278**	**1,857,940**	**1,846,650**	**1,931,796**

North American production in 1929 is correctly stated, but the distribution by countries is not precise. So far as possible, production in the United States from Canadian and Mexican ore is deducted and credited to its country of origin, but production from other foreign ores is not so segregated. (*a*) Included in "Elsewhere."

SILVER — FINE OUNCES

Country	1925	1926	1927	1928	1929
United States	61,377,977	60,918,000	59,412,000	56,149,000	60,357,000
Canada	20,228,988	22,371,924	22,736,698	21,922,795	22,039,000
Mexico	92,912,000	98,291,000	104,575,000	108,536,000	101,000,000(*a*)
Bolivia	5,174,000	5,834,003	5,402,840	5,573,000	5,046,000(*a*)
Peru	20,746,909	22,523,036	18,295,408	20,541,000	21,163,000
Australasia	10,915,091	11,225,360	11,005,797	10,500,000	8,904,000(*b*)
India	4,854,923	5,124,962	6,024,806	7,425,000	7,279,000(*c*)(*a*)
Elsewhere	25,487,299	26,760,888	26,641,039	27,333,266	30,212,000
World total	**241,697,187**	**253,049,173**	**254,093,588**	**257,980,061**	**256,000,000(*a*)**

(*a*) Estimated by *Engineering and Mining Journal*; (*b*) Australia only (*c*) Burma only.

Gold

Robert J. Grant

Restriction of Amount of Gold Used in the Arts May Be Necessary

PRODUCTION of gold in the United States for the calendar year of 1929 totaled 2,128,027 oz. With the exception of the years 1871 and 1872, this is the smallest output since California started producing following the discovery of placer gold in the state in 1848. The output in 1929 is 105,224 oz. less than the 1928 production, and is a decline of more than 50 per cent as compared with the rate of production as recent as 1916.

Although production figures for other countries are not available at present for 1929, the indications are that world production will be less than in 1928, and it is apparent that world prospects point to continued decline in the future.

Some increase in production may be reported for South Africa and for Canada, but the aggregate will not be important. The premier gold producer in Canada has had a poor year, but other mines seem to have more than made up the difference. Chief interest apparently has shifted from the Porcupine area to the Kirkland Lake district. Apparently something will have to be done eventually to increase the value of gold if the monetary needs of the world are to be adequately met. Even though schemes to that end are frequently proposed, nothing practicable has been suggested as yet. It would not be surprising, however, if before many years steps are taken looking to the restriction of the amount of gold allowed to go into the arts. In fact, a tax on gold intended for such use has been proposed in recent years in bills introduced in Congress. No action on such a measure has been taken, however. Plans looking to the payment of bonuses for the production of gold usually are opposed because of their effect on the whole financial structure.

Some interesting facts with regard to gold, taken from the latest statistics that are available, follow:

The total value of domestic coinage of gold during the last fiscal year, ended June 30, 1929, was $39,945,000. The Philadelphia mint coined 1,779,750 $20 gold pieces; 662,000 $10 gold pieces, and 416,000 $5 gold pieces.

Gold acquired by the government at the various mint-service institutions during the fiscal year totaled $249,716,845.02. This does not include gold coin received by the mints for recoinage, so that the aggregate amount of gold handled at the mint-service institutions during the fiscal year was $503,702,578.14.

At the end of the last fiscal year the estimated stock of domestic gold coin in the United States was $1,407,888,924. The stock of gold bullion in the mints, assay offices, and federal reserve banks on the same date amounted to $2,916,461,936.

For the calendar year 1928, gold consumed in industrial arts was estimated at $59,080,659, of which $31,569,500 was new material. This shows a decrease of $238,000, compared with the estimate covering the preceding year.

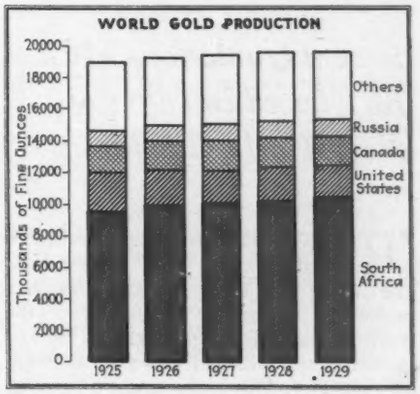
During the fiscal year the only gold coinage executed for other countries was an order of 25,000 pieces of two colones, for Costa Rica.

The value of fine gold bars issued in exchange for gold coin during the fiscal year was $193,255,796.56. This represents a material increase over the figures for the preceding year, when the total was $110,739,807.90. The amount exchanged for bullion was $3,554,240.74. This was slightly less than the amount thus exchanged during the preceding fiscal year.

During the fiscal year the entire receipts of gold bullion at the various mint-service stations were as follows: Philadelphia, $255,899,523.18; San Francisco, $30,650,349.21; Denver, $15,034,840.93; New York, $201,024,955.93; New Orleans, $2,132,744.89; Carson City, $157,735.98; Boise, $320,403.69; Helena, $205,795.86; Seattle, $6,976,387.10; Salt Lake City, $18,664.45.

The mints during the last fiscal year manufactured 132,452 gold commercial and certificate bars. They operated upon ingots containing 4,776,439.54 oz. from which 40.6 per cent of gold coin was produced.

The latest final figures on world coinage of gold are for the calendar year 1927. In that year the various nations using gold coins minted $258,634,092 worth. The United States is by far the largest producer of gold coin. Next on the list is the Union of South Africa, which in 1927 produced gold coins valued at $80,204,611. The value of Mexico's gold coinage was $15,104,550, and Switzerland produced $19,357,900. Preliminary figures available for 1928 show a total coinage of gold of $285,977,651. The detailed figures available for that year are: United States, $177,360,000; Austria, $1,513,767; Union of South Africa, $88,680,035; Czechoslovakia $41,856; Ecuador, $100,000; Egypt, $9,886; Tunis, $249; Mexico, $13,409,650; Netherlands, $1,310,248; Persia, $53,024; Peru, $24,936; Roumania, $3,474,000.



In 1928, as usual, the United States was the large consumer of gold for industrial purposes. For that use, $59,080,659 worth of gold was employed. The United Kingdom was next with $11,369,506. Other large users were: Egypt, $9,094,236; Switzerland, $6,978,300; Germany, $1,715,040; Mukden district of China, $1,929,364; Portugal, $1,568,456; Amoy district of China, $1,116,279.

Monetary stocks of the principal countries of the world in 1928 aggregated $10,526,952,000. Since the discovery of America the world has produced 1,021,655,069 fine ounces of gold.

Gold coin as a medium of circulation becomes progressively more unpopular in the United States each year. Because of the custom of presenting gold pieces at Christmas time, there always is a large demand for gold coin just prior to the holidays, but most of it flows back into the Treasury before many weeks pass.

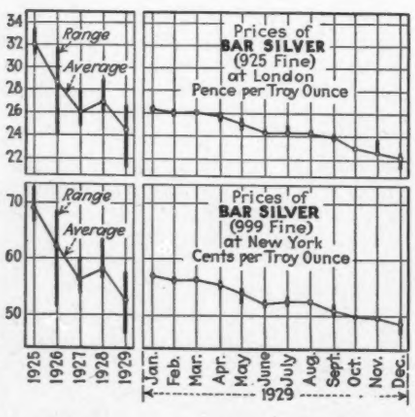
Added to the inconvenience of carrying a coin of small size with relation to its value, difficulty is also frequently experienced when worn gold coins are tendered to banks. The deduction of even a small amount to cover loss from the standard weight creates a prejudice against the acceptance of gold coin. To these objections has been added the increasing practice of sweating gold coins. By this process, as much as $2 worth of gold can be extracted from a double eagle without affecting the inscription on the coin.

Silver

Benjamin White

Recent Quotations Must Be Viewed in Light of New World Conditions

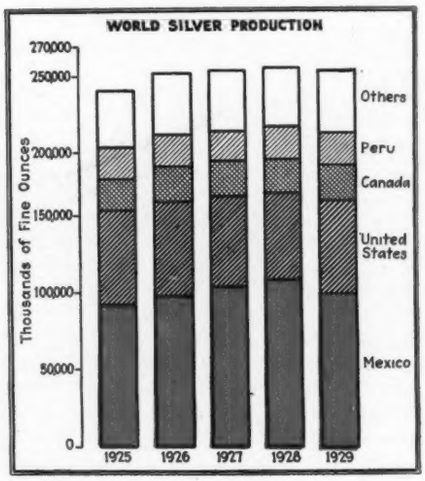
TO ONE who has been associated with the London silver market from the inside for 45 years, and who has watched its many vicissitudes (involving the fall in price to 21 11/16d. in November, 1902, and the rise to 89½d. in February, 1920), the present level of quotations, notwithstanding the fact that the year 1929 entirely lacked any sensational occurrence, is not without interest. The low prices in the closing months of 1929 should not be set against previous low records without due allowance being made for the tremendous change in world conditions since the Great War. The world-wide advance in the cost of the necessaries of life—say, 50 per cent as measured in gold—should enter into any comparison between the actual worth of silver now and then, for it should be remembered that silver is a commodity that finds a ready market in certain parts of the world in exchange for other commodities, and its real value is as measured in them.



Previous to 1873, an artificial premium was placed upon the metal by an agreement of the Great Powers to mint it at a certain ratio to gold. When this was abrogated, the premium dropped until the average price in the decade before the war fell to about 26d., as against that of 62d. Instead of surplus production automatically entering European mints for coinage, silver poured into the populous countries of the Far East in ever-increasing quantities. India, as the value of silver cheapened, was prepared to place still more upon its women and children in the form of jewelry, while China and central Asia welcomed it to balance their exchange of raw material and foodstuffs with the manufacturers of the West. Allowing for the increased cost of mining and that of other commodities, manufactured or otherwise, surprise would not have been felt if, other things being equal, the price of silver had increased up to 50 per cent above 26d.—the average pre-war figure—that is to say, from 26d. to 39d., for the increase in the production of silver has not been disproportionate to that of the world's population. The present worth of silver, however, calculated in that of other commodities, is much below that which obtained when the lowest sterling record price was touched in 1902, perhaps even to the extent of 40 per cent. When we remember that world values of commodities have now lost almost entirely the restraints to which they were subjected in, and since, 1914, and have reached a condition which must now be looked upon as almost normal, this fall in the world's appreciation of silver is remarkable, and an attempt to ascertain the reasons is well worth consideration.

First of all, during the last fourteen years the world has learned that subsidiary coins are actually tokens and that, provided currency systems are maintained upon a stable gold basis, money that changes hand to hand can be composed of paper or base metal without detriment to the general convenience or safety. As a result, not only have substitutes been brought into use, but the contents of such coins as are still minted in silver have been reduced, and the supplies of the silver market have been augmented by vast quantities of demonetized metal. The market has been long aware that an enormous stock of silver is held by the Indian government, composed of treasure that once figured in the reserve against the note issue, and that it has been prepared to unload at each favorable opportunity that may recur. Hence prices could hardly fail to decline.

The astonishing thing is that quotations have fallen so slowly and so little, considering that the market had to deal with record mining outputs plus heavy sales of demonetized metal. The reason for retardation is that one great tract of country—China and central Asia—with about 400,000,000 people, is not unwilling to take silver at a falling gold value, and a population comprising a quarter of the human race is no negligible factor. Alongside of this outlet is ranged the industrial consumption



of India, with its population of more than 300,000,000. In the latter country, silver is a mere luxury; in the former it can always be used as a medium of exchange for the commerce of the interior.

The collapse of prices in 1929 can be summed up in one word—saturation. A sponge can absorb only a certain amount at a time, and, if it is to continue to function, the contents must from time to time be released. One sign of repletion is the accumulation of silver in the visible stock at Shanghai. In 1913 the total, composed of sycee, dollars, and bars, was about 51,000,000 oz.; toward the close of 1929 the total had risen to 194,000,000 oz., an increase of nearly *fourfold*. Although the unrest of China has been a factor in this situation by concentrating silver in Shanghai for safety, the ease with which silver can be obtained in the world's markets is undoubtedly the main cause, and, were the Chinese not deterred from importing Western manufactures owing to their heavy cost (based on the rise in wages and material), the pressure of falling silver rates would have been even more acute. The balance of trade has therefore been so heavily in favor of China that unusually large imports of silver have had to be made in order to liquidate that balance. This fact is by no means a bull point for silver, for, should China's internal difficulties diminish, the impact of Western civilization will be felt so keenly that the standard of life in China will rise and import trade recover. In that event more manufactured goods will be taken from the West in exchange for the raw material of China's myriad workers,

and less silver will be required to balance the account. China's troubles cannot, however, be expected to end within a year or so. No Mussolini seems likely to arise in that country of immemorial custom, where affairs of war and state are transacted with the deliberation and leisure of a game of chess. But it will come. The reverberations of the Great War still echo around the valleys and the mountains of remote districts where, at the time, its very existence was not known, and a new era has dawned for every nation, China included.

No mintage of importance took place during the year 1929. The Royal Mint in London, having no coin to strike for home use in gold, and comparatively little in other metals, has undertaken contracts for Continental countries. In these the silver is provided, not by purchase from the open market, but from material derived from the reduction in quality of Home and Colonial coinage.

Turning to the quotations of 1929, the highest for cash delivery was 26 7/16d. on Jan. 7, 10, 12, and 14; the lowest, 21 5/8d. on Dec. 30. This was a record —the previous lowest quotation being 21 11/16d. on Dec. 4, 1902. The average price in 1929 was 24.460d., as compared with 26.46d. in 1928. The fact that silver for cash was at a discount to that for forward delivery practically throughout 1929 indicated the forlorn character of the market, which deteriorated rapidly toward the close of the year.

What, then, is the future of silver? When the price was about 26d. mining interests used to argue that production would fall off so seriously at each fall that a penny or so would mark the end of the decline. This argument has lost much of its weight, for, notwithstanding the higher cost of mining, silver is extracted in undiminished volume, and yet the price recedes. Should, therefore, sales of demonetized metal continue to be made at each lower price level, the outlook must be far from good. Demand for luxury purposes in the West can hardly be expected to show much improvement when the attractions of motor cars, travel, radio, and other amusements compete with a display of plate that requires the attention of trained servants. The demand for film purposes, however, is substantial and increasing.

On the other hand, the only hope of increased demand for coinage seems to be in China or possibly in Russia. The former appears to have a long way yet to go before that internal unity can be secured which would enable it to reorganize its currency system. The latter has some terrible crises to face before its unfortunate people can find rulers under whom a stable currency could be assured, which would enable silver coins to remain in circulation.

Precious Stones

GEORGE FREDERICK KUNZ

THROUGH the control of the Diamond Syndicate and the great care which the South African government has exercised in marketing the stones recovered in the government workings in Namaqualand, the diamond market still remains stable. The demand is good, particularly for the better grades and the larger sizes. Instead of being the detriment to the market that was so freely predicted at the outset, the Namaqualand material has been a benefit, in that it has supplied the market with a plentiful supply of a quality of goods of which previously there was an insufficient quantity to meet the demand.

The extraordinary finds of diamonds in Namaqualand and the adjacent territory in Southwest Africa still continue to be a center of interest in the diamond industry. Since monthly returns of production are no longer made public, and since the Namaqualand output was not included in the official preliminary report for 1928, it is only recently that accurate information has been available on the output and it became known that it was even greater than early reports had estimated it to be. Official figures for the Namaqualand output in 1928 were 906,493 carats, making the total for the Union 4,372,857 carats. This is an increase of half a million carats over the earlier estimates, and, with one or two other countries where the later figures showed increases over the preliminary estimates, will bring the world's total for 1928 about on a par with, or possibly even a shade ahead of, the peak year 1927, when the total was 7,363,000 carats.

The 1928 operations skimmed the cream from the Namaqualand deposits, and the first half of 1929 showed returns of only 161,168 carats. Alluvial production outside of Namaqualand, and mine production for the Union for the first six months of 1929, showed an output slightly above the 1928 level, and the total output for the half-year was 1,903,126 carats. Further decline in the Namaqualand output during the remainder of the year will be more or less offset by the increases in other alluvials and in mine stones, indicating a year's total of about 3,800,000 carats.

Namaqualand's decrease in production is due not only to a lessening in output but also to cessation of output for several months, partly on account of the unsettled conditions in the district. This territory has produced, in less than two years, diamonds valued at $35,000,000, and enough more are in sight to indicate a production worth $5,000,000 a year for the next ten years. About one-half of the stones thus far recovered in the government diggings have been placed on the market, and the remainder are being held for future sale. These same deposits have been traced across the Orange River into Southwest Africa, and ground has already been blocked out that is estimated to contain 1,000,000 carats.

The drop in the South African production will be partly offset by increases from Southwest Africa, the Gold Coast, and Tanganyika. New finds in British Guiana also indicate a probable increase there. If Congo and Angola equal their 1928 outputs, a world total of about 7,000,000 carats may be expected for 1929; and should these two sections show increases similar to those recorded in 1928, the total would again be at the peak level.

The diamond-cutting industry continues to expand in South Africa. Last August, seventeen establishments were in operation, as compared with eleven in January.

A most outstanding contribution of 1929 to the literature of the industry is Dr. David Draper's "The Birth of the Diamond Industry in South Africa," now being published serially in the *South African Mining and Engineering Journal*, beginning with the issue of Aug. 10, 1929. Coincident with the publication of the fifth installment of this historical summary of the industry, the publishers announced the death of Dr. Draper on Sept. 9.

Various methods of geophysical prospecting have been developed during recent years, and lately the torsion-balance method has been used to outline the peridotite plug in Pike County, Ark., and to search for other peridotite intrusions in the vicinity. Diamonds from the deposit were first described by the writer in 1907. A total of about 5,300 stones has been found, but there has been no production in recent years.

Of great interest is the fact that a deposit of about 25 beryl crystals that are 12 and 14 ft. in length and 14 in. in diameter has been found in a feldspar quarry near Albany, Me. They are probably the largest crystals of any mineral known, and a proposal has been made to preserve the locality as an unusual mineralogical exhibit. If this is not feasible, a few of the specimens may be removed to some of the well-known larger museums.

In addition to two beryl mining operations in the Transvaal, a third deposit of considerable extent has been opened up in Namaqualand. Large tonnages of material are now available with an analysis of 10 to 15 per cent beryllium oxide (BeO), and this wealth of raw material has given impetus to recent efforts to develop commercial uses for the metal. The demand, however, is still small, and the present commercial possibilities of the deposits rest entirely on the relatively small proportions of emerald found with the beryl.

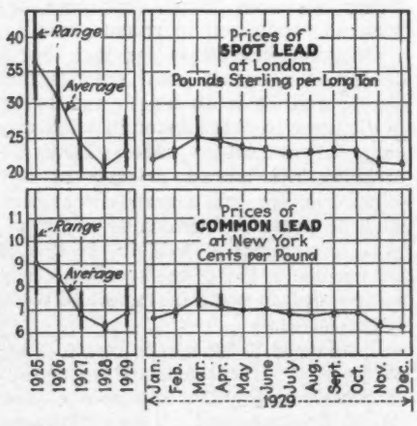
Lead

Clinton H. Crane

New World Production Record Established—Outlook Promising

IN REVIEWING the lead situation it is fitting to glance over the statistical reports for the year to ascertain if and where any records were broken. In 1929 at least one important mark seems to have been shattered—world lead production. A record high for all time, of 1,930,000 tons, was attained, with the probability that this estimate will prove conservative after final tabulations have been made. This mark was reached despite the fact that production in the United States of 687,000 tons exhibited only a moderate growth over the production of 1928, although near the record of 1926. The reason for the increased output was doubtless the better prices of lead which prevailed over the most part of 1929 as compared with 1928. As usual, higher prices brought out more lead.

The increased lead production was fairly general throughout the world, but was particularly noticeable in Germany, Australia, Mexico, and Peru.



Although the lead produced by these countries is sold almost entirely on the basis of the London metal market, where prices ruled lower than in New York and hence give a correspondingly lower stimulus to increased production, many foreign lead mines are extremely cheap sources of supply. A marked exception to the generally increased lead production of 1929 occurred in Spain and Tunis, as shown in the table below.

Contrary to popular impression, the world's production of lead from year to year has been close to the world's output of copper. As a matter of fact, for the years 1924-1928, inclusive, the average world production of lead was 1,722,000 tons, compared with 1,662,000 tons of copper, giving lead a slight advantage. However, in 1929 preliminary estimates indicate that world copper production was over 2,100,000 tons, so quite likely copper is the first of the three non-ferrous metals, copper, lead, and zinc, to cross the 2,000,000 tons' mark.

World Production of Pig Lead

In Short Tons

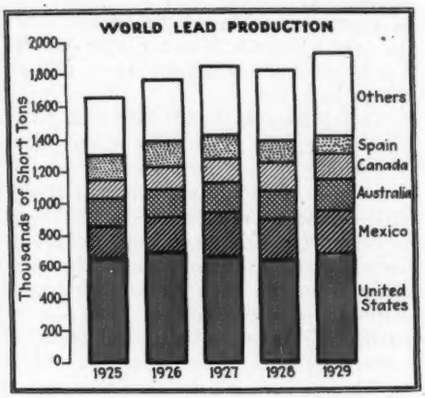
	1927	1928	1929(a)
United States.	673,000	650,000	687,000
Canada	156,000	170,000	158,000
Mexico	274,000	261,000	270,000
North America ...	1,103,000	1,081,000	1,115,000
Australia	185,000	183,000	193,000
Spain and Tunis	173,000	155,000	114,000
Germany and Silesia	92,000	96,000	123,000
Burma	74,000	88,000	90,000
Others	231,000	244,000	295,000
Totals	1,858,000	1,847,000	1,930,000
Average New York lead price, cents per pound..	6.755	6.305	6.833

(a) Estimated.

A noteworthy fact is that Peruvian lead output increased from 14,700 in 1928 to 20,000 tons in 1929 and promises to expand further as the difficulties of establishing a lead-producing industry in Peru are gradually surmounted. During 1930, the Mount Isa property, in Queensland, Australia, will probably become a substantial producer of lead and zinc. Official announcement was recently made that Mount Isa would produce lead at the rate of 70,000 tons per annum initially. This amount of lead will help Australia to retain its important position as the third largest lead-producing country and to replace the tonnage lost by the exhaustion, or prospective exhaustion, of some of its older lead properties.

Those mines, new as well as old, that contain complex silver-lead-zinc ores have been seriously affected by the sharp price declines in all three of these metals. Ordinarily, on the principle of diversification, such enterprises should have a stronger position than mines producing only one class of ore, but the principle is of no avail when all three metals are affected in the same way.

Although the price of lead in New York averaged only about one-half cent higher in 1929 than in 1928, the average does not tell the whole story. In February, the lead market staged an unusually brisk advance under the supposition that supplies of lead coming from Mexico would be greatly diminished by virtue of the recent revolution



in that country. Even though the uprising was of short duration, it was long enough to dam up some Mexican lead from this important source of supply. Under the spur of a better lead market—prices well above 7c.—many producers jumped in to take up the slack left momentarily by Mexico. And then occurred one of those unfortunate cycles in the lead market which both producers and consumers are anxious to avoid—a sharp rise in the price of lead to 7.875c. and a subsequent sharp decline to 7c. in April.

The aftermath was an accumulation of lead which plagued the market later on, at the very time when least desired. Stocks of lead in the United States and Mexico grew from 35,000 tons in April to 70,000 tons in September, and consequently, in October, when the stock market collapsed, the price of lead showed little resistance to a downward tendency, reaching a low for the year of 6.25c., a level at which the year was ended.

Just as higher prices brought out more lead, so lower prices effected a natural corrective of the situation. Mining companies began to decrease production, and, on the average, it amounted to a cut of perhaps 10 per cent among producers in the important lead-producing states of Missouri, Utah, and Idaho. Wage rates were unaffected.

The lead market is a world market, with the United States producing only 35 per cent of the total output, and is peculiarly sensitive to disturbances which affect production or consumption in any important quarter. Normally, the lead market moves slowly. When an extraordinary disturbance, such as a revolution, takes place, the necessary adjustments are difficult to make quickly

enough to counteract the possibility of violent market fluctuations.

An erratic lead market gives much discomfort to fabricators. The tendency among manufacturers, whether they produce white lead, ammunition, or other lead products, is to set retail prices for the finished material that will hold for protracted periods, sometimes as long as a year. They are governed by problems of distribution which are both peculiar to the various lead industries and the outgrowth of long-established trade practices. Sharp fluctuations in the price of raw materials play havoc with sales policies, which is why fabricators prefer slowly moving raw-material markets.

The demand and use of lead in 1929 in the United States was excellent on the part of storage-battery and lead-covered cable manufacturers, the two principal outlets for the metal. Prosperity of the storage-battery industry is intimately linked, but by no means exclusively, with the growth and development of the automotive industries. Record-breaking automobile output in 1929 —5,600,000 cars—indicates that probably a record-breaking amount of lead was used in battery manufacture last year.

About a year ago, predictions were made that about 5,000,000 cars would be produced in 1929: a very conservative estimate, as later events demonstrated, even though it appeared otherwise at the time. Today, predictions range from a maintenance of the annual rate of output of 1929 to a slight decline in 1930. In either case, the battery makers can look forward hopefully, particularly as the replacement market for existing motor vehicles will be larger in 1930 than it ever was and may more than compensate for any halt in the growth of the new-car demand. Moreover, besides their use in automobiles, storage batteries are employed for many other purposes. Mine locomotives, industrial trucks, public utilities, submarines, and other applications exist which annually consume large numbers of storage batteries.

Cable makers had a record year and took about 200,000 tons of lead in 1929. Only eight years ago, the consumption of lead for that use was 93,000 tons. These figures indicate what a rapid increase has taken place in the lead-covered cable business in the intervening years. The end is not in sight, and general expectations are that this use of lead should grow from year to year as facilities for telephone and power lines are improved and made immune to storms and other disturbances of a similar character.

White lead has not fared so well in recent years. As is well known, competition among paint pigments is extremely keen, and the public has not been generally educated as to what constitutes a good durable paint. Cheaper substitutes have made heavy inroads in the white-lead business. White-lead consumption was slightly better in 1929 than in 1928, but much room for improvement exists.

An interesting development among the minor uses of lead is that tetra-ethyl lead is being used in rapidly growing amounts in anti-knock gasoline. Although the present consumption is only about 2,500 tons of lead per year, this outlet for lead will be quite important if the present phenomenal rate of growth in consumption continues.

With regard to technical developments in 1929, no major improvements occurred. The lead blast furnace is being extensively studied at the Salt Lake City station of the U. S. Bureau of Mines, with promise of fruitful results in smelter operations. In flotation practice, the tendency is to place the process on a more scientific foundation than hitherto. Flotation continues to be an extremely important tool of the lead producer.

Platinum

H. W. BOYNTON

SPECTACULAR price movements, which have featured the platinum market in recent years, were lacking in 1929. From the opening price of $70 an ounce, which proved to be high for the year, the course of the market was steadily downward, with no intermediate rally. The closing price was $61. Production continues at a rate beyond the capacity of the market to absorb. Competition among sellers is keen, and even small orders are apparently considered of sufficient importance to warrant shading of prices below levels that return normal profits. In the absence of control, the only hope for stable prices is a closer relationship between production and consumption. Apparently the market is now seeking its economic level, but in spite of its relatively low price, platinum has probably not yet touched bottom, according to present indications.

Costs of production vary with the producing locality, and figures are not generally available. The accuracy of such costs as are obtainable is open to question. A continued shrinking of the selling price must eventually curtail high-cost production and bring about a better equilibrium. Except for byproduct platinum, which is not important in amount, Russia is unquestionably the lowest cost producer. Russian platinum is still being marketed by the Soviet, independent of other producers and dealers.

Statistics for the United States, issued by the U. S. Department of Commerce, seem to show a 22 per cent increase in consumption of platinum for 1928, as compared with 1927. These figures probably involve some duplication. It is impossible to reconcile them with changes in stocks on hands at the end of the respective years, nor are they world-wide in scope. Although no consumption figures for 1929 are yet available, undoubtedly they will show a noticeable decline from those compiled for 1928.

The decline in the price of iridium, which started in the early part of 1928, continued in 1929. Prices fell gradually, but uninterruptedly, throughout the year. The market opened in January at $275 an ounce. This was the high quotation for the year. A gradual fall of prices carried iridium down to about $185 an ounce at the end of December. The considerable increase in imports, coupled with subnormal business in the jewelry industry, probably accounts for the decline. A downward tendency seems still to prevail in the market, but the statistical position of iridium is better than that of platinum or palladium, and barring developments at present unforseen, the price should be close to the bottom.

The palladium market was dull and featureless throughout 1929. From an opening price of $40 an ounce, the market receded gradually, closing at $36 without any intermediate reactions. The market evidently could not absorb the heavy increase in imports, and, as the potential supply of palladium is large, the price seems likely to continue to decline.

According to the U. S. Department of Commerce, imports of platinum in the first eleven months of 1929 were 112,758 oz., representing an increase of 13,098 oz. compared with the same period of 1928. Iridium imports were also higher than in the preceding year, the figures for eleven months being 4,124 oz., in 1929, as against 3,541 oz. in 1928. Palladium, too, was imported in considerably greater quantity in 1929 than in 1928, the 1929 total being 22,464 oz. for eleven months, whereas that for the same period of the previous year amounted to 11,216 oz.

Nothing of an encouraging character is apparent for the immediate future prospects for any of the platinum-group metals. Osmium and osmiridium imports for the eleven months totaled 7,443 oz., compared with 5,967 oz. in the same period in 1928, according to official records. Importations of rhodium and ruthenium in the January-November period amounted to 3,020 oz., compared with imports totaling about 2,712 oz. in the same period of the preceding year.

Cobalt

G. C. BATEMAN

CONSUMPTION of cobalt in 1929 increased, the output from Ontario for the nine months ended Sept. 30 being 55 per cent greater in quantity and 30 per cent greater in value than for the corresponding period of 1928. The combined total output of metallic cobalt and the metallic content of oxides, salts, and unseparated oxides for the nine months was 703,694 lb., valued at $1,379,829, compared with 460,995 lb., valued at $1,090,130, for the same period of 1928.

No change in the price of raw ore occurred, and it continues at 2c. per unit per pound for ore containing 5 per cent or more metallic cobalt. For instance, for an 8 per cent ore the shipper would be paid 16c. per pound for 160 lb. of cobalt. Payment is also made for the silver in the ore, and when the ore is low in silver and high in cobalt no smelting charge is made.

A fairly active demand for ores continues from Europe and from American agents who are presumably acting for European buyers. Prices higher than those recorded here are often quoted, but, on account of delays, regulations regarding packing, and the confidence in the ready market available in Ontario, little ore is shipped out of the country. Most of the cobalt is a byproduct of the high-grade silver ores and concentrates for which the best market is in Ontario. Contracts are usually made for the entire output.

Sources of cobalt have not changed, these being the copper-cobalt ores of the Belgian Congo and the arsenical cobalt-nickel ores of Ontario. Experimental work in selective flotation, however, indicates that this method of recovery may be applied to low-grade deposits that have not as yet been mined.

The demands for, and the uses of, cobalt are constantly expanding. The most important new development in 1929 was the wide application of cobalt-tungsten-carbide alloys in the manufacture of cutting tools. The cobalt in these alloys gives increased strength and prevents oxidation when the tools are operated at such high speeds that the cutting edge becomes red hot. Stellite, a cobalt-tungsten-chromium alloy, is coming into much more general use, not only for cutting tools but more particularly for depositing on surfaces subject to great wear. By means of the electric arc or acetylene torch stellite is deposited on certain surfaces, such as the tops of grizzly bars to protect them from wear. It is also used to build up worn surfaces on machinery parts of cast iron or steel. The alloy is now being used in nearly every industry for these purposes, and in 1929 consumption of stellite increased markedly. Use of cobalt in permanent magnets is also expanding, owing to the fact that a cobalt steel magnet has the same magnetic power as an ordinary steel magnet two or three times as large.

The price of cobalt metal, f.o.b. the Ontario refinery, is $2.50 per pound, and for black oxide, $2.10 per pound. Substantial concessions are said to be made from these prices to encourage a greater use of cobalt in the steel trade.

Asbestos

NORMAN R. FISHER

GENERALLY speaking, 1929 was an unusually prosperous year in the asbestos-mining industry. Complete statistics are expected to show a substantial increase in sales, compared with those of any previous year, at very satisfactory prices. World output was about 450,000 tons, as compared with 390,000 tons in 1928, and nearly all the asbestos-producing centers contributed to this marked advance.

Prices ruling for the longer grades, such as crude and spinning stocks, were appreciably higher than the average for the previous year; those for the shorter grades, such as shingle and paper stocks, averaged about the same.

Canada sold 273,033 tons of all grades in 1928, having a total value of $11,238,361, or an average value of $41.16 per ton. Sales for 1929 were about 310,000 tons, and the average value was about $44 per ton.

Rhodesia shipped 39,960 tons in 1928, at an average value of $118.23. Shipments for 1929 totaled about 43,000 tons, with an average value of about $98 per ton.

South Africa shipped 24,053 tons in 1928, at an average value of $78.68 per ton. Shipments for 1929 were about 35,000 tons, and the average value was about $71 per ton.

Shipments from Cyprus totaled 18,241 tons in 1928, the average value being about $60 per ton. Shipments for 1929 were about 26,000 tons, the average value continuing unchanged.

Russia produced about 27,000 tons in 1928, at an average value of about $80 per ton, and is reported to have done better in 1929.

The United States produced 2,239 tons in 1928, having an average value of $156.88 and the record for 1929 will show little change as compared with these figures.

Italy produced about 5,000 tons in 1928, and is reported to have improved this record slightly in 1929.

Prospects in the asbestos-mining industry for 1930 are problematical, as they are dependent upon the state of general industrial conditions..

Aluminum

DOUGLAS B. HOBBS

SEVERAL outstanding developments in the use of aluminum occurred during 1929. The increasing demand for structural shapes possessing the strength of mild steel and the lightness of aluminum has led to the erection of a blooming and structural mill at Massena, N. Y., that is capable of producing, in the strong aluminum alloys, structural shapes 14 in. in depth and 90 ft. in length. This mill will handle blooming ingots weighing 2,000 to 3,000 lb. Development of the casting technique for such ingots and the design of satisfactory heat-treating equipment for large structural shapes are noteworthy metallurgical achievements.

Light weight is now considered essential in motor-truck and street-car construction, but until recently the application of aluminum was limited because large structural shapes were not available. With the advent of these, new uses for aluminum in street cars and motor trucks immediately became apparent. The advantageous use of these large structural shapes has been particularly well demonstrated in the construction of cranes. For instance, a 50 per cent saving in weight has been effected by their utilization in the construction of a 10-ton crane. Moreover, this weight reduction is favorably reflected in the performance and operating costs of the crane.

In this "Rustless Age," aluminum is being used for both the exterior and interior ornamentation of buildings, owing to the fact that the metal is resistant to atmospheric corrosion and no painting is necessary to preserve it. Also, aluminum forms no colored compounds that streak or stain the structure on which it is placed. Two of the more important applications of aluminum in architecture have been in the erection of the Chrysler building, in New York City, and the Cathedral of Learning, of the University of Pittsburgh, at Pittsburgh, Pa.

Because of the resistance of aluminum to hydrogen sulphide, aluminum equipment is employed in the oil fields of west Texas and the Texas Panhandle. Aluminum cable is used both for the transmission of power and for the swing-lines inside of storage tanks. Several aluminum tanks have been in successful operation for nearly two years, and a much broader use of aluminum for this purpose is indicated. The application of aluminum paint to oil tanks is well known. Today, aluminum foil is also used in the oil fields and at refineries for preserving steel and wood.

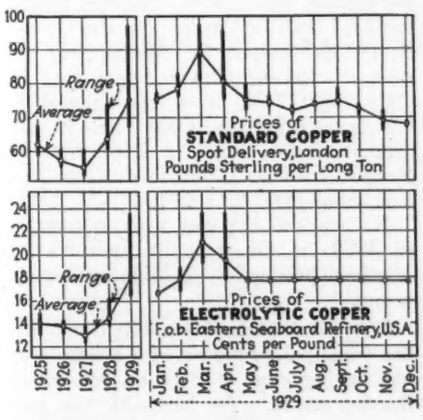
Throughout the last year, aluminum was used in increasing quantities for aircraft construction.

Copper

Arthur Notman

Assured Expansion of Consumption Paramount Need for the Future

EXTRAORDINARY expansion of the copper industry, which began in the second quarter of 1928, culminated a year later in April, 1929, when, according to the American Bureau of Metal Statistics, world production reached a maximum for all time of 196,820 tons, compared with a monthly average in 1928 of 159,706 tons. Total stocks of blister and refined copper in North and South America, Great Britain, Havre, and Japan were reduced 17,879 tons in the first quarter of the year, and on April 1 amounted to 313,895 tons. A steady growth from that time brought the figures on Sept. 1 to 375,131 tons, an increase of nearly 20 per cent. In response to this condition, production was curtailed drastically late in May and was held at about 175,000 tons per month up to November. In December this rate was further reduced to 165,344 tons, or nearly the 1928 average, but stocks increased to about 436,984 tons on Jan. 1, 1930. This



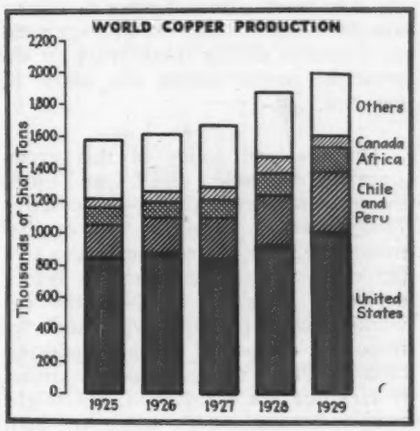
is an increase of more than 40 per cent since April 1, 1929.

During the four years ended with 1929, both world production and consumption increased about 45 per cent. The average rate of increase per decade for the last eighty years has been about 65.6 per cent, which is equivalent to about 5½ per cent increase compounded annually. The maximum increase occurred in the ten years ended with 1890; this amounted to 86.4 per cent and was equivalent to a little less than 7 per cent compounded annually. No period of ten years has shown a rate as high as that of the last four years.

The price of the metal, which in April, 1928, was about 14c. a pound, rose steadily, reaching a maximum of 24c. a pound the following March. The average *Engineering and Mining Journal* quotation for that month was 21.257c. Reaction followed promptly, the April figure being 19.50c., since which time the price of the metal has been maintained at 17.775c., f.o.b. refinery.

The favorable combination of low costs, the outcome of strenuous efforts in effect since 1921; increased production; and rising prices resulted in record prosperity for the industry. How long this level of prosperity can be continued depends primarily upon the course of general business. Evidently it passed its peak in the first quarter, long before any evidence of serious weakness developed in the securities market. A year ago, in an article on copper, I gave tables of statistics covering a group of twenty of the principal North and South American copper companies, the production of which aggregated between 63 and 66 per cent of the world's output for each year since 1923. Comparing the five-year average ended with 1915 and current performances, this group of companies has more than doubled its rate of output, in the proportion of 2.2 to 1. At the same time, it has more than doubled its rate of distribution of bond interest and dividends, in the proportion of 2.3 to 1. This affords further evidence of the unparalleled prosperity. I have now brought these statistics up to date, as shown in the two tables on this page.

The figure of 6.88c. per pound produced, now being paid out in bond interest and dividends, or 38.7 per cent of the selling price, should be compared with a figure of 4c. a pound and 23½ per cent of the selling price which this group of companies has paid out on the aggregate production from Jan. 1, 1911, to Jan. 1, 1929, of approximately 30,000,000,000 lb.



The weighted average price received by these companies for the production mentioned was 16.95c. per pound. Twenty-seven and a half per cent of the total output was sold during the war and post-war boom period at an average price of 23.35c. per pound. If this period be omitted, the weighted average on the balance was only 14.16c. per pound. During the high-price period of the war, the dividends and bond interest

Tables I and II—North and South American Copper Companies Producing 65 Per Cent of World Total

Table I

Year	Production, Pounds (000 Omitted)	Bond Interest and Dividends Paid (000 Omitted)	Cents Per Pound	Percentage of Average Selling Price per Pound Paid Out
1924	1,923,200	$49,000	2.55	19.6
1925	2,029,900	64,090	3.18	22.6
1926	2,112,500	75,040	3.55	25.7
1927	2,142,400	82,560	3.85	29.8
1928	2,491,600	94,910	3.81	26.8
Current rate, estimated	2,500,000	172,143	6.88	38.7

Note—Production for 1929 will be in excess of 2,750,000,000 lb.

Table II

Year	Market Value Closing Quotations Each Year (000 Omitted)	Average Yield on Market Values, per Cent	Market Value per Poun of Annual Production, Cents
1924	$1,159,600	4.2	60
1925	1,142,000	5.6	58
1926	1,140,500	6.6	54
1927	1,435,500	5.6	67
1928	2,439,000	3.9	98
Current rate	1,919,600	9.0	77

Note—Market values are based on closing quotations for each year on all outstanding securities of the group. The market value for the current rate was taken at the closing prices of Dec. 10, 1929, and the yield was taken at the current rate of distribution, which is higher than the actual for the calendar year 1929.

paid out per pound were 6.30c. and 27 per cent of the selling price. These comparisons clearly demonstrate the unprecedented prosperity of the industry in 1929.

Referring now to Table II, we can understand the public uncertainty as to the continuation of this level prosperity. To find a precedent for the current yield of 9 per cent we must again return to the war years. Such figures as I have available indicate that the average yield in dividends during those years on the principal copper stocks was about 8½ per cent.

The dividend policy of this group since the depression of 1921 and up to the present time has been conservative (see Table I). Current rate of distribution apparently represents about 70 per cent of estimated earnings before depletion. Bearing in mind the net working capital of the group and the respective companies' excess producing capacity, this is not an undue proportion if earnings are maintained, but might readily become so if either or both output and selling price were to be substantially reduced. At the end of 1924, the net working capital stood at $221,000,000. At the end of 1928, it had increased to $315,000,000, at which time current assets totaled $453,000,000 and current liabilities $100,563,000, or a ratio of 4½ to 1. Net working capital at the close of the year 1929 was about $350,000,000.

The argument now frequently advanced in support of the present price level is that no more copper could be sold at lower prices than at 18c. If this argument is sound, why not at 50c. or even $1? It immediately becomes obvious that a price that in the light of history affords an undue proportion of profit is open to attack from many directions, whereas one that is based on the average margin of profit shown in the past, and that has been ample, will stand on solid ground. Any commodity in general use, with adequate supplies, will command a wider market at lower prices. It must be recognized, of course, that the price shall protect the margin which history has shown to be necessary to maintain adequate sources of supply of the commodity.

In spite of rising costs resulting from increased wages and increased taxes, curtailed output, and a growing inefficiency that inevitably accompanies undue prosperity, there can be no doubt of the fundamental soundness of the industry as a whole and of certain units therein in particular. The paramount need for the future is an assured expansion of consumption to absorb idle capacity of existing mines and plants and the new supplies of the metal from Canada and Africa destined to enter the market in growing volume in the near future.

Graphite

BENJAMIN L. MILLER

FEW developments of note occurred in the graphite industry in 1929. The most interesting and far-reaching in its effect was the further accentuation of the increased demand for the lower grades of graphite—dust, fine flakes, amorphous, and artificial—and the decreased demand for crystalline lump, chip, and large flake. This tendency has had a serious effect on the industry, inasmuch as formerly, in almost every country of the world, the profits were derived from the sale of the best grade of material, the lower grades being sold for whatever they would bring and frequently at a loss. In 1924, the last time a census of the consumers of the United States was made, the following distribution of the product as to uses was revealed:

Uses	Per Cent
Foundry facings	51.5
Pigments and paints	18
Crucibles	13
Pencils and crayons	5
Commutator brushes	5
Stove polish	1.5
Lubricants	1
Miscellaneous	5

Since that time a still further decrease has taken place in the use of graphite crucibles, the only article of importance which demands the highest grade graphite. The table is strikingly different from similar compilations prepared before the war, in which crucibles accounted for 55 per cent of the product; stove polish, 15 per cent; and foundry facings, 10 per cent. Still further inroads are threatened in that various articles are being substituted for graphite for foundry purposes.

Although graphite of good quality and quantity has been found in over half of the commonwealths of the United States, and worked at some time in most of them, domestic production has constituted only 15 to 19 per cent of domestic consumption. Many factors have contributed to this condition, and much discussion has been given to the subject; however, the situation does not change materially from year to year. The imposition of an important tariff increased the percentage slightly, but not enough to make the graphite industry prosperous. Operators are again striving for an increased tariff, whereas the graphite manufacturers favor lower tariff duties. The present prospects for increased tariff seem promising. A representative of the operators has recently gone on record to the effect that, with a continuation of present conditions, the flake graphite industry of the United States is doomed.

Throughout the country, Alabama is likely to be regarded as the leading graphite-producing state of the Union, a position which it once held. It still contains the largest number of producers, even though nearly all the companies formerly operating there are either now idle or have gone out of existence. In 1929, the following companies were in operation: the Ceylon plant, of Southwestern Consolidated Graphite Company, at Hollins, Coosa County; the Bama Graphite Company, at Mountain Creek, Chilton County; and Superior Flake Graphite Company, at Ashland, Clay County. Less of the product went into crucibles and more into foundry facings, paints, greases, and dry batteries. The flake graphite sold for 5 to 8c. per pound and the lower grades for 2½ to 4c.

Ceylon, Madagascar, Mexico, Chosen (Korea), and Canada were again the principal foreign producing countries.

The decrease in the manufacture of graphite crucibles, for which nearly all the high-grade Ceylon graphite formerly was used, has seriously crippled the graphite industry in Ceylon, and, added to this situation, is the substitution of lower-priced Madagascar flake for Ceylon lump and chip. In the first five months of 1929, exports were about 1,000 tons less than in 1928. For the entire year, exports may prove to be a trifle greater than in the preceding year. Efforts are being made to decrease the costs of exploration, mining, and treatment of the ore, and also to stimulate sales. Measures for the improvement of the industry are receiving the support of the government. The demand for the lower grades has been greater than for the higher. Lump sold in 1929 for 7 to 9c., chip for 5½ to 7c., and dust for 3 to 5c.

The substitution of Madagascar flake for Ceylon material in crucibles manufactured both in Europe and the United States has helped the Madagascar industry. Recent data indicate that in 1929 about 7,000 tons was shipped to England, 2,500 to 3,000 tons to the United States, 1,500 to 2,000 tons to France, 1,500 to 2,000 tons to Germany, and about 1,000 tons to Italy.

No marked changes were noticeable in 1929 in the graphite industry of Mexico, production continuing nearly normal.

The Black Donald Graphite Company, the principal producer of Canada, was idle during most of 1929, on account of flooded mines. To Nov. 30, the production was 1,134 tons, of which 936 was amorphous and fine flake and 198 tons good flake. A fair demand prevailed for the former, but not for the latter.

A discovery of vein graphite of promising character was reported in southwest Namaqualand in 1929.

The demand for artificial graphite appears to be increasing and three companies are manufacturing it.

Zinc

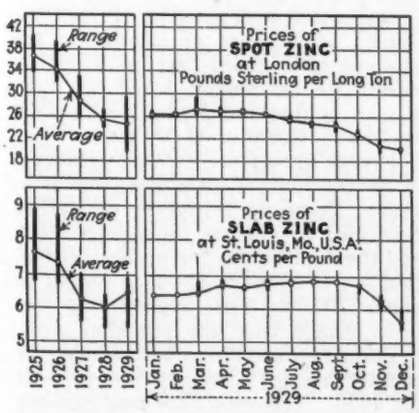
Julian D. Conover

Consumption Fails to Keep Abreast With Enlarged Production

FOLLOWING the post-war depression of 1921, each succeeding year has witnessed an increase in the world's production of slab zinc, and the year 1929 proved no exception. Production for the year is estimated at 1,610,000 tons, an increase of about 2 per cent above that for 1928.

Of the principal zinc-producing countries, all except Belgium and France shared to some extent in the increased output. The United States continued to produce about 40 per cent of the world's total, with Belgium, Poland, Germany, France, Canada, Great Britain, and Australia following, each with the same relative position as in 1928. These eight countries produce fully 90 per cent of the total, with the remainder divided among other countries of the Continent of Europe, as well as Japan, Mexico, and Rhodesia.

Consumption of zinc failed to keep full pace with the enlarged production, and an accumulation of stocks of zinc ore and metal, combined with expectations of further increases in production, resulted in pronounced weakness in the



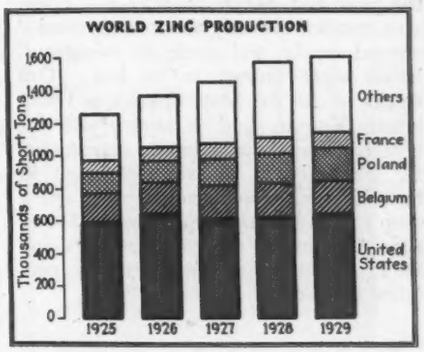
market. The London zinc price, which reached a figure of £29 per long ton in March, 1929, dropped in November to a little below £20, the lowest level in over twenty years, and closed the year just slightly above the low point. The St. Louis price, which had held steady at close to 6.80c. per pound from the first of April to the middle of October, suffered a corresponding decline. This drop was first made necessary by the threat of foreign importations, which otherwise could have paid the tariff duty and undersold the domestic product; but the impetus of the movement carried the domestic price below the import equivalent, to a low point of 5.45c., which was also the low point previously reached in March, 1928.

At the end of 1929 the European Zinc Cartel, after a life of a year and eight months, was abandoned. Curtailment of production by its members had proved insufficient to prevent the market collapse, and subsequent efforts to bring together in a workable agreement the various interests in Europe and those shipping metal to Europe have been unsuccessful.

As a result of present low prices, it is reported that one of the British smelters and possibly some of those in Continental Europe will shut down, and that some of the mines supplying zinc ore on contract have taken advantage of the "stop" clause in their contracts, applicable when the price goes below a certain specified figure, to suspend shipments.

Ore supplies from Australia will probably show some decrease at the end of June, 1930, when the present English contracts to buy them at a price above the current market are terminated. On the other hand, some of the European smelters controlling their own ore supplies are said to be continuing full operations; and additional production is to be expected from a number of new electrolytic zinc plants which are proposed, or under construction, or recently placed in operation in Norway, Poland, Germany, and France. Additions to existing plants are also being made at Risdon, Tasmania, and at Trail, in British Columbia; a new electrolytic plant is under construction at Flin Flon, Manitoba, and other plants are proposed in eastern Canada and in Peru; furthermore, the retort zinc smelter of the American Smelting & Refining Company situated in Mexico has been considerably enlarged.

Improved metallurgy, particularly in selective flotation, and vigorous prospecting operations have in the last few years made available tremendous quantities of zinc-bearing ore in many parts of the world; and some of the aforesaid plant extensions are intended to bring into production these newly developed orebodies or to permit larger-scale operations at existing mines. A distinct addition to the world's zinc supplies is thus involved. Additional supplies of zinc ore are also to be expected within the next few years from northern Argentina, from Burma, and from Mount Isa, in Australia; large zinc deposits in Siberia, Bolivia, and other less accessible parts of the world await a



more distant future. Expansion of production from the large lead-zinc deposits of Rhodesia has been held up because of the excessive amount of water encountered.

The zinc industry of the world appears to be facing a period of readjustment, and this is reflected in the present market price for the metal. A considerable part of the new zinc coming on the market is from mines in which the major values consist of lead, copper, and precious metals, and consequently the output will not be affected by unfavorable zinc prices to the same extent as if zinc were the predominant metal. Nevertheless, the extraordinarily low prices of both silver and zinc, combined with a moderately low lead price, will to some extent undoubtedly curtail production and interfere with plans for expansion.

Under the conditions described in the foregoing it is natural that the United States zinc industry should have witnessed in the last year nearly a complete disappearance of its export market. Exports of zinc ore, which in 1926 amounted to 95,000 tons, dwindled in 1928 to 4,500 tons, and in 1929 were practically nil. Exports of slab zinc, except for the bonded metal produced from Mexican ore, also diminished in the latter part of 1929 to less than 100 tons per month. This changed position of the United States is emphasized by the fact that, though the total slab zinc production of the United States has in the last seven years increased 60 per cent, the production of the rest of the world has increased more than 125 per cent, and the proportion of the world's total produced outside of the United States has increased from 50 per cent to about 60 per cent. This change is probably of a permanent nature, and the American zinc industry, assisted by its tariff protection, must in the future de-

pend largely upon the domestic consumption of its product.

Within the United States output of zinc ore and zinc metal increased in 1929, bringing the production of the latter almost up to the 1926 post-war record of 638,000 tons. Stocks of metal increased during the year, however, to a total of 77,000 tons at Dec. 31, as compared with 45,000 at the beginning of the year and 34,000 at May 1. These zinc stocks were only about seven weeks' normal supply, and stocks in consumers' hands were known to be low. Ore stocks in the Tri-State district of Oklahoma, Kansas, and Missouri also increased, though to a lesser extent, and the combined effect was witnessed in the aforesaid drop in metal price and a drop in the Joplin ore price from $44 to $35. Operations at retort smelters and at Tri-State mines were severely curtailed toward the end of the year.

The Tri-State district continued in 1929 as the major source of zinc ore in the United States, producing about 45 per cent of the country's total. Most of the mines in this district continued to operate on a single-shift basis. The average number of mills operating during the year, including 22 tailing retreatment plants, was 114, but curtailment of operations in the last two months reduced this to an average of 92. The production of flotation zinc concentrates increased to nearly one-fourth of the total output, and installation of sintering equipment at many of the retort smelters resulted in a preference on the part of buyers for these lower-priced ores. A number of large new mills of steel construction were built during the year to handle the ore from tracts of a hundred to several hundred acres, as compared with the 40-acre tracts common in the central part of the district.

The new electrolytic plant of Evans-Wallower Zinc Company, at East St. Louis, began operations late in 1929, using Tri-State zinc concentrates.

Zinc production of the Western states, which was rapidly expanded in 1924-1927 by the application of selective flotation to complex ores, continued at approximately the same level in 1929 as in 1927 and 1928. Montana, Utah, Colorado, Idaho, and New Mexico again produced the bulk of the Western output. The Empire Zinc Company's new mill near Gilman, Colo., started operations late in the year. In Arizona, metallurgical studies were continued looking toward utilization of the complex zinc orebodies of the United Verde mine, which are likely to be developed when cheap power becomes available. The Sullivan electrolytic plant, in Idaho, which was started late in 1928, operated steadily throughout 1929, and the Star mine was reopened to supply a part of its ore requirements. Lead-zinc production of a number of Utah and Idaho properties was curtailed about 15 per cent at the end of the year.

Of the zinc-mining districts east of the Mississippi, increased production in Virginia and New York has marked the last few years, whereas the production of the Wisconsin district dropped sharply in 1928. Additional production is expected from mines developed by the United States Steel Corporation in eastern Tennessee.

Retort smelters of zinc have completed a number of plant remodeling programs making for substantially increased efficiency, particularly in the roasting of zinc ores. The new vertical type of retort, charged at the top and permitting continuous instead of intermittent distillation of zinc, is in successful commercial operation at two plants and installations are being made at two others.

Prospects for zinc in the coming year obviously depend largely upon the degree of activity in industries consuming this metal. About two-thirds of the zinc consumed in the United States goes into zinc-coating (galvanizing) of steel and the making of brass, and the zinc pigments, zinc oxide and lithopone, account for another 20 per cent of the total. All of these products will evidently be benefited by the program of building construction and general activity projected in recent national business conferences. New uses for zinc are also being developed, particularly in the field of die-casting. The use of sheet zinc for roofing and other purposes, which has consumed a large tonnage of the metal in Europe, has lagged behind in the United States, owing to lack of knowledge of the excellent qualities of properly applied zinc roofs. To correct this condition, a "Zinc Workers' Manual" was issued by the American Zinc Institute last year, giving detailed information on methods of construction and places in which zinc can be used to advantage for sheet metal work.

With a productive capacity, at zinc mines and smelters, considerably in excess of the present consumptive demand, the zinc industry has some difficult problems with which to contend. The enlargement of consumption, through increased market research and advertising, appears to be one of the essential steps in meeting this situation.

Sulphur and Pyrites

RAYMOND F. BACON

APPARENTLY 1929 was a record year for the sulphur industry of the United States. Estimated total shipments amounted to 2,350,000 gross tons, representing an increase of about 13 per cent, compared with the 2,082,924 tons shipped in 1928. This increase is evidence of greater industrial activity throughout the world, as shipments both to domestic consumers and to foreign countries were appreciably larger than in the preceding year. Total exports will probably be in excess of 800,000 tons, an increase of about 115,000 tons over the 685,000 tons reported for 1928 by the U. S. Department of Commerce. Shipments in 1928 to domestic consumers totaled 1,396,000 tons, whereas those in 1929 amounted to about 1,550,000 tons. Production for the year is estimated at 2,400,000 tons, an increase of about 420,000 tons over the record for 1928. Part of this increased production supplied the greater demand for shipments, and the balance went into stocks.

The Texas Gulf Sulphur Company began operations at its new property, Boling Dome, at Newgulf, Tex., the latter part of last March. The output, which was in excess of 300,000 tons, has all been put into storage, no shipments as yet having been made from that deposit. Texas Gulf's plant at Gulf, Matagorda County, Tex., continues to operate without interruption. This company, according to reports, has obtained a third sulphur area at Long Point, Tex., which it is now developing.

Freeport Sulphur Company operated its deposits at Bryan Heights, Tex., and at Hoskins Mound, Tex., continuously throughout the year at a satisfactory rate of production.

The Texas Gulf Sulphur Company and the Freeport Sulphur Company continue to be the chief factors in the industry, producing 97 to 98 per cent of the output of the United States.

The Duval Texas Sulphur Company started production late in October, 1928, and, according to reports, installed a second battery of boilers in August, 1929, that greatly increased its plant operating capacity. Tax reports of Texas show a production of approximately 35,000 tons of sulphur in the eleven months ended Sept. 30, 1929. A reasonable assumption based on these figures is that the production in 1929 was about 40,000 or 45,000 tons.

Pyrites imports in 1929 are estimated at 480,000 tons, or about the same as in 1928. Domestic producers of pyrites continued to operate throughout 1929, and the final figures for pyrites production are expected to show an output of about 200,000 tons, representing but little change from the preceding year.

Business institutions throughout the country are forecasting a normal year for 1930. The year 1929 may possibly have been a peak year for the sulphur industry, but, in view of the yearly growth of that industry, normal sales and shipments have moved probably onto a higher plane. If so, a total production of about 2,300,000 tons for the next few years may be expected, instead of 2,000,000 tons, as in recent years.

Iron

Edwin C. Eckel

World Production and Consumption Reach New Record Totals

THE YEAR 1929 witnessed a world record in the production of iron ore, though by a considerably narrower margin than might have been anticipated in view of the general optimism at the beginning of the year. It also witnessed, except for Great Britain and Germany, records established higher than in any past year by all of the leading countries producing iron ore. As for actual consumption of iron ore during the year, that probably also established a world record for all time, though by a still narrower margin than has the production. And the net result of these relations is that at the end of the year 1929 we have a far larger quantity of iron ore carried over in stock, at mines, at ports, and at furnaces, than in any other year in the world's industrial history.

In regard to the United States, the previous record dates back to 1916, when we were supplying Allied needs while still exempt from war difficulties. In the figures for Great Britain and Germany, the previous record years are of course pre-World War. In the data for France, and for practically all other countries, the previous records were those established in 1928. In regard to Germany, the present deficiency is, of course, due to the loss of her chief iron-ore districts at the end of the World War, and this loss, at present, must be considered irretrievable. Great Britain's present deficiency is due to the general industrial difficulties that occurred as a direct consequence of the decision to restore the pound sterling to its pre-war value: and as that decision was the result of financial considerations, it need not be considered as irrevocable.

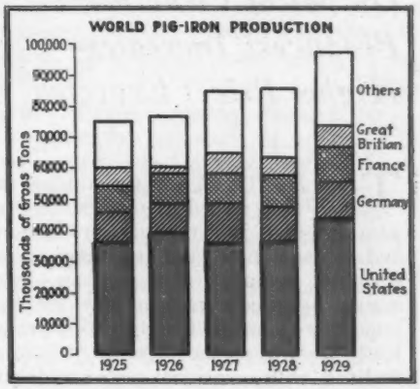
The average price per ton of merchant iron ores, all over the world, certainly attained in 1929 a new height for all time; and if the boom had not collapsed during the year, the prices for 1930 and later years might have reached fantastic levels. For at the very height of the boom, in mid-summer of 1929, the leading German steel interests negotiated new long-time contracts with nearly all the great ore producers—namely, Algeria, Wabana, Armorica, and Sweden. And in each case, inasmuch as the Germans were not mental supermen, but ordinary shopkeepers with ordinary foresight, the contracts covered ten to fifteen years' requirements at prices per ton far higher than the existing deliveries. The average increase in price for contracts extending to 1938 and 1943 was 2 to 4s. per ton.

Of course, none of these contracts will ever be strictly executed, for, unfortunately, iron ore "contracts" are still in the condition that steel "contracts" were twenty years ago, before Judge Gary insisted on ordinary business honesty in their regard. That is to say, an agreement to buy iron ore at a definite price becomes a "contract" if the market goes up; it becomes a simple "option" if the market drops. In either case the iron-ore producer is the victim. It is to be hoped that in the next few years this situation will be changed for the better.

The manner in which the tremendous world boom of 1922-1929 finally culminated is a matter of some interest; and in the accompanying table I have noted the months of 1929 in which each country attained its maximum output of pig iron and of steel.

Months of Maximum Output in 1929 by Countries

	Pig Iron	Steel
United States	July	May
Germany	July	January
France	January	January
Great Britain	August	March
Russia	July	July
Belgium	January	August
Luxemburg	August	August
Poland	July	January
Italy	No data	May



When a tremendous and long-continued world boom is ready to collapse, it is, obviously, a very serious error to concentrate attention on the growth or decline of output in any single country, or even of any single continent.

As for the prospects of the immediate future, that the verbal efforts of politicians or bankers can avert a market and world-wide stagnancy in 1930 does not seem probable. The heavy stock of ore now on hand, under such circumstances, will weight seriously on ore and prices in the Atlantic basin, at least.

Iron Ore Mined and Shipped in the United States in 1928 and 1929

THE FOLLOWING table, compiled by the U. S. Bureau of Mines, shows the quantity and value of the iron ore mined and shipped in the United States in 1928 and 1929 by the principal producing states. The figures for 1928 are final, but those for 1929 are subject to revision.

	Ore Mined (Gross Tons)		Ore Shipped			
			1928		1929	
District	1928	1929	Gross Tons	Value	Gross Tons	Value
Lake Superior:						
Michigan	13,676,984	15,560,000	14,241,102	$37,039,644	16,843,000	$47,679,000
Minnesota	37,564,005	45,878,000	38,129,018	94,258,899	46,496,000	122,188,000
Wisconsin	1,284,592	1,621,000	1,394,371	3,700,797	1,790,000	4,850,000
	52,525,581	63,059,000	53,764,491	$134,999,340	65,129,000	$174,717,000
Southeastern States:						
Alabama	6,307,844	6,435,000	6,159,863	$11,599,176	6,616,000	$12,646,000
Georgia	73,052	63,000	73,052	209,877	63,000	192,000
Missouri	94,899	164,000	94,899	377,847	164,000	647,000
North Carolina	.....	34,000	.....	.....	34,000	94,000
Tennessee	128,928	98,000	128,478	286,524	98,000	211,000
Virginia	27,902	.....	27,970	83,114	(a)	(a)
	6,632,625	6,794,000	6,484,262	$12,556,538	6,975,000	$13,790,000
Northeastern States:						
New Jersey	250,332	278,000	350,616	$1,357,877	281,000	$1,170,000
New York	712,757	830,000	767,743	2,906,055	861,000	2,857,000
Pennsylvania	1,027,870	1,127,000	1,013,791	2,411,114	1,148,000	2,870,000
	1,986,959	2,235,000	2,132,150	$6,675,046	2,290,000	$6,897,000
Western States	1,051,923	1,195,000	1,051,923	$1,557,733	1,195,000	$1,603,000
Grand total	62,197,088	73,283,000	63,432,826	$155,788,657	75,589,000	$197,007,000

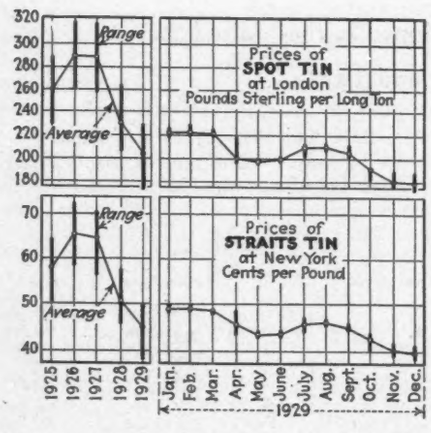
(a) Virginia reported shipments of 232 gross tons, valued at $631.

Tin

E. Baliol Scott

Output of Principal Producers Increases—Higher Prices Expected

THE HISTORY of tin mining in 1929 is a record of remarkable expansion—both as regards production and consumption—and of continuous struggle against falling prices, not merely by producers generally but by important interests, loosely and conveniently known as the "Group." Prices declined, with occasional recovery, from the beginning of the year until early in December, when "three months" sold down to £173 in London for cash Standard and at 38.55c. in New York. From this level prices recovered sharply on rumors that restriction of output had been arranged among producers. The average price for the year in the United States was 45.155c. per pound for Straits, and the London average price for spot metal was £203.85 per long ton. As the average price for 1928 was £227.131, the average-price decline in 1929 was £23.281. Although much less than the decline in 1928, which exceeded £60, that of last year was much more



severely felt, and enforced closing down of some of the less economic producers seems inevitable.

Naturally, under these conditions, the year has been a disappointing one. Reiterated prophecies, emanating largely from the "Group," that arrangements for stabilization had been effected and that any further decline was arrested, did not help the situation. On a less superficial view, however, the record offers considerable cause for satisfaction. In the first place, consumption showed a remarkable increase; in fact, production up to the end of September, as measured in "deliveries," accounted for all of the extra output, and if American deliveries had not declined coincident with the Wall Street collapse, stocks would probably have been about the same at the end of 1929 as they were at the beginning of the year. Owing to increases in the stocks of tin in unofficial warehouses—and therefore outside that comprised in "visible supplies"—statistics of visible supplies on various dates have not had the significance attributed to them in the past. For this reason, reference may be made to figures of production and deliveries which fully substantiate the view that production and consumption were almost balanced for the greater part of the year.

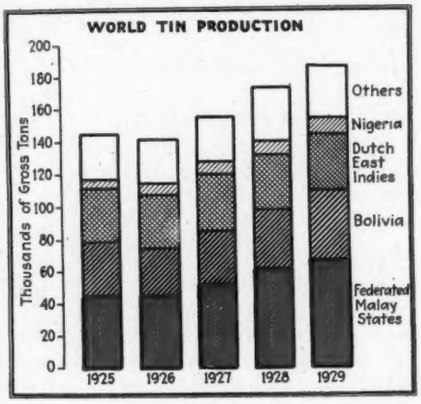
Production of Tin, First Eleven Months, 1928 and 1929

In Long Tons

	1929	1928	Change
Federated Malay States	61,194	56,649	+ 4,545
Banka	12,202	12,471	— 269
Dutch ores to the Straits	19,369	18,990	+ 379
Siamese, Indian and African ores to the Straits	12,338	10,389	+ 1,949
Nigeria	9,746	8,182	+ 1,564
Bolivia	39,117	36,738	+ 2,379
Totals	153,966	143,419	+10,547

Statistics published in *The Mining Journal*, up to the end of October, 1929, show a total of 140,218 long tons, as compared with 128,680 long tons for the same period of 1928, or an increase of 11,538 tons. United States deliveries for the same period were 76,775 tons, compared with 64,565 tons for the first ten months of the previous year, an increase of 12,210 tons. Moreover, deliveries in Europe in 1929 exceeded those of 1928, so that, speaking statistically, to the end of October no evidence of production increasing over supply of metal was discernible. Most of the anxiety felt on this score resulted from fear that the major influence responsible for the increased tin deliveries—namely, the American automobile industry—would be drastically curtailed. In recent months, European deliveries expanded markedly, and have to a large extent offset the lower American takings. For this, Russia is largely responsible, but the uncertainty of the economic position and policy of that country adds to the difficulties in judging the probable trend of requirements for Europe and outside countries for which no current statistics can be obtained.

Another factor that added to market anxiety was the widespread impression that the stocks which do not appear in the visible supply were larger than normal. The market was informed at the end of October that the carry-over in the Straits amounted to 4,575 tons, and



at the end of November that it totaled 4,150 tons, compared with a normal figure of a few hundred to 2,000 tons. Such large monthly carry-overs in the Straits probably pressed more heavily on the market than the actual figures would have, had they been precisely ascertained and added to the visible supply at the end of each month.

To determine at present to what extent the reduced price of the metal has been responsible for increased deliveries is difficult. So far as the United States automobile and tin-plate trades are concerned, it probably made little difference, though the recoveries of secondary metal are expected to decrease, and to that extent consumption of primary tin should be stimulated. In other directions, however, consumption has been encouraged; for instance, the German net imports increased substantially in 1929.

Production figures for the first eleven months of 1928 and 1929 are listed in the accompanying table. These show the position of the leading producing fields and indicate a net increase of 10,547 tons for the 1929 period. In view of the uncertainties of the situation and the possibility that restriction is already in effect, it would not be advisable to estimate the total for the year by averaging the figures for the eleven months and adding this amount to the eleven-month total. Minor producers, such as Australia, Cornwall, China, Spain, and Portugal, have felt the slump more than the larger producers, and their respective records of output in 1929 are therefore probably lower than in 1928.

As shown in the table, an increase in production has occurred in all the leading producing fields with the exception

of Banka. However, as the amount of Dutch ore converted into "Straits," rather than "Banka," tin is growing, this decline is apparent rather than real. Particularly noteworthy is the fact that, despite all the outcry about production at a loss, all producing centers show an increased output in 1929. The Dutch mines would probably be the last to feel low prices, in so far as ability to produce at some profit is concerned. Obviously, therefore, the restriction of total output from these mines in 1929 to about that of 1928 is a matter of policy and not of necessity.

One fact that is not apparent in the table, but which is worth notice, is that production increased month by month until the end of October. In November, however, total production was 553 tons less than that in October, 1928, despite a record output from the Federated Malay States. Whether producers in some centers are at last being forced by recent low prices to restrict output or, whether, on the other hand, restriction by arrangement is being practiced, is not clear at present. Reduction has been chiefly in shipments from Bolivia, which declined by 1,548 tons in October and November.

Is artificial restriction being practiced or is it likely to be practiced in the near future? Last summer, largely through the efforts of Mr. John Howeson, managing director of the Anglo-Oriental Corporation, the Tin Producers' Association was formed, and efforts were made to induce producing interests to arrange some basis for co-operative restriction. These measures have resulted in the formulation of a provisional plan whereby operations would be suspended for 32 hours every week-end and for an additional week in January, February, and possibly March, of 1930. The plan is believed to have the promise of support from the major Bolivian interests and to be acceptable in Nigeria, where Anglo-Oriental interests predominate. Major European producers in the Federated Malay States are understood to have given provisional adherence to the plan should co-operation be forthcoming from foreign interests operating in Bolivia and the Dutch East Indies. The reaction of the Chinese interests in Malaysia is uncertain, but it may be determined by the course of the tin market in the next few weeks. The plan is obviously not a complete one. Should it go into operation, figures will have to be established as to the levels at which restriction will cease to operate and, in the event of reaction, be again imposed. Moreover, arrangements may have to be made regarding the declaration of visible stocks and the price at which these are to be liquidated.

In regard to price prospects in 1930, a feeling has developed in tin circles that tin has probably reached bottom at about £170 per ton. Prices have fallen fairly steadily from about £325 early in 1927, and would have undoubtedly fallen much more rapidly and continuously but for the predictions that the "Group" would hold prices above certain figures. The decline having been thus retarded, producers were enabled to some extent to meet the changed conditions. The dredge output from Malaysia has expanded rapidly, a widespread opinion prevailing among tin operators that production costs have been diminished materially below what were a short time ago considered post-war standards. Omitting consideration of deliberate restriction, it would be difficult to determine to what price tin would have to fall before a material reduction in the world's output would occur. As long as the belief is general that any current low level can be of only short duration, the majority of producers will probably try to avoid the disorganization and costs incident to closing down. Moreover, many underground mines would, in the present period of financial strain, experience difficulty in securing fresh capital within any reasonably short period for resuming operations. A large number of producers, however, cannot show a reasonable mining profit at current prices, which means that resources are being depleted without profit to shareholders or even additions to company capital. Hence, when prices do turn and a rising market is experienced, such producers will not be in a position to increase output.

In conclusion, therefore, inasmuch as the market obviously cannot go much lower for any length of time, and assuming that world consumption does not decline markedly, my view is that in 1930 prices will tend toward higher levels. After three years of decline, we may reasonably expect the pendulum to swing the other way, though, of course, if the present attempts at arranging co-operative restriction come to nothing, we may witness a sharp temporary slump.

Nickel

THOMAS W. GIBSON

NINETY per cent of the world supply of nickel comes from mines situated in the Sudbury district of Ontario, Canada; the other 10 per cent is obtained chiefly from deposits on the island of New Caledonia, in the southern part of the Pacific Ocean. The Sudbury ore consists of masses of mixed pyrrhotite and chalcopyrite, with pentlandite as the actual nickel-carrying mineral. These mines, with the exception of the recently acquired properties of Falconbridge Nickel, are now largely owned and operated by the International Nickel Company of Canada, Ltd., which recently took over the properties of the Mond Nickel Company—the only other producer in the district—including the refinery in Wales. The quantity of ore smelted in 1929 was about 2,000,000 tons, and the nickel content in the resulting matte amounted to about 58,000 tons. This compares with an output of 48,377 tons of nickel in 1928. Copper output in 1928 amounted to 33,303 tons, and in 1929 to about 43,000 tons. The ore came principally from the Creighton, Garson, Levack, and Frood mines.

The rapidly growing demand for nickel and the discovery of unusually large and rich bodies of copper ore in the Frood mine, which is now owned entirely by the International Nickel Company, have led to a remarkable expansion of the Sudbury nickel-copper industry. A construction program, adequate for the changed situation, is being carried out. The main building at Copper Cliff will house the reverberatory furnaces and converters. A concentration plant, operation of which is a new departure for the International Nickel Company, will handle about 6,000 tons of ore per day by flotation methods. Two products will be recovered—namely, a high-grade copper concentrate and a copper-nickel concentrate. These products will be charged directly to the reverberatory furnaces. The main smelter building is practically all closed in, and the brickwork on the 520-ft. stack is completed. All the converters and furnaces are in place and work on the bins is proceeding. A refinery for the treatment of the blister copper is being erected by the Ontario Refinery Company, Ltd.; at present the electrolytic section is housed in and the foundations for the tanks are completed. Adjoining the electrolytic plant will be the copper-bar furnace and the anode storage building. These processes will be carried on under one roof, the finished building covering about 11½ acres. The power house has been completed, and the necessary machinery is being installed. Associated with the main plant are the chemical works of Canadian Industries, Ltd., which will manufacture niter cake, for the International Nickel company, and sulphuric acid. Expenditures for this expansion, including changes and improvements in the company's nickel refinery at Port Colborne, will amount to $24,000,000.

In New Caledonia—at present the only other important source of nickel—two companies, Société Le Nickel and Société Caledonie, exported in the first eight months of 1929 a total of 3,366,557 kilos of matte, containing from 74 to 84 per cent nickel. This output represents a lower rate of production than that in 1928. Efforts to produce refined nickel are being continued.

Quicksilver

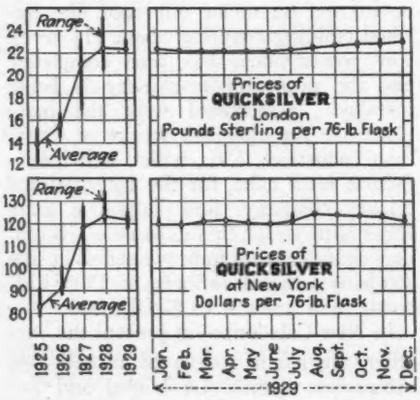
H. W. Gould

World Output Declines —American Production Continues to Increase

THE TREND of the price of quicksilver in 1929 followed closely along the price levels established in 1928. Sales in the United States ranged from $115 to $130 per flask, with demand brisk throughout the year. In London and Lausanne, Switzerland, the price range was from £21 to £22.

Production of the metal in the United States in 1929 shows an increase over the record for 1928, but was not as pronounced as that of 1928 over 1927. My estimate for the year is between 21,000 and 22,000 flasks. Imports were about the same as for 1928. Apparent consumption in 1929 will be a little higher, probably about 34,000 flasks. Stocks in bonded warehouses on Dec. 31, 1928, were 5,496 flasks, and on Sept. 30, 1929, were only 2,531 flasks. European stocks are still high, but are closely held by the quicksilver cartel or trust.

As usual, world figures of production are not yet available for 1929, but reports from abroad indicate a considerable reduction from the average annual production of the last two years of about 150,000 flasks. A marked reduction in output was made in Italy, and to a lesser extent in Spain, and it is my opinion that the world production last year will not greatly exceed consumption, and will be about 125,000 or 130,000 flasks.


Range
Average
Prices of QUICKSILVER at London Pounds Sterling per 76-lb. Flask
Prices of QUICKSILVER at New York Dollars per 76-lb. Flask
1925 1926 1927 1928 1929
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
1929

The production of quicksilver in Mexico has declined, and does not average 200 flasks per month, but new producers may increase this somewhat in 1930. It is also possible that the production of the quicksilver mines operated by the Kaikohe Development Company, Ltd., in New Zealand, a subsidiary of Imperial Chemical Industries, may materially increase during 1930. A French company in Algeria has started to produce a limited quantity, and the Karbausan mine, in Asia Minor, continues to operate on a small scale. In Japan, a rotary furnace that is being installed by the Yamato Suiginzan Kogyosho, at Osawa, will probably be placed in operation early in 1930.

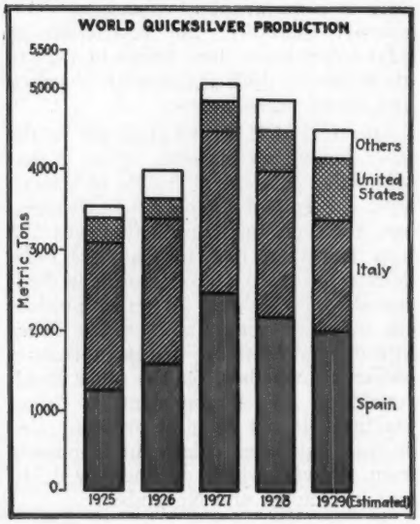
In the United States, the industry has continued to flourish, with the old mines operating and with new mines being opened from time to time. The greatest increase in production was made in Nevada, which produced between 5,000 and 6,000 flasks in 1929. The largest producers in the state are: Nevada Quicksilver Mines, Inc., and the Pershing Quicksilver Company, near Lovelock; the Castle Peak mine, near Virginia City; and the B. & B. mine, south of Mina. Many lesser producers are scattered throughout the state. A further increase in Nevada is probable in 1930.

The State of Oregon also reported the largest annual production ever recorded in its history, with the Blackbutte property, near Cottage Grove, and the Mercury mine, near Opalite, having the bulk of the production. Washington has two producing mines, the Morton cinnabar property and that of the Consolidated Mercury Mining Company, near Morton.

Production has not increased in Texas, the Chisos mine continuing to be the largest producer. During the year the Study Butte mine was reopened and is now in production. The Arizona Quicksilver Corporation and the Mercury Mines of America are the leading producers in Arizona. Production of the state is still small. In California, the New Idria mine is the leading producer, with the Oceanic, Knoxville, Cloverdale, Sulphur Bank, LaJoya, Oat Hill, and Aetna properties all making a fair production.

As in 1928, no radical changes were made in the metallurgy of quicksilver in 1929. Many refinements, however, were made in the present standard rotary furnace and condensing system, and in many of the latest installations cast-iron pipes that have been cast centrifugally are used successfully in the type of condensing system now commonly employed.

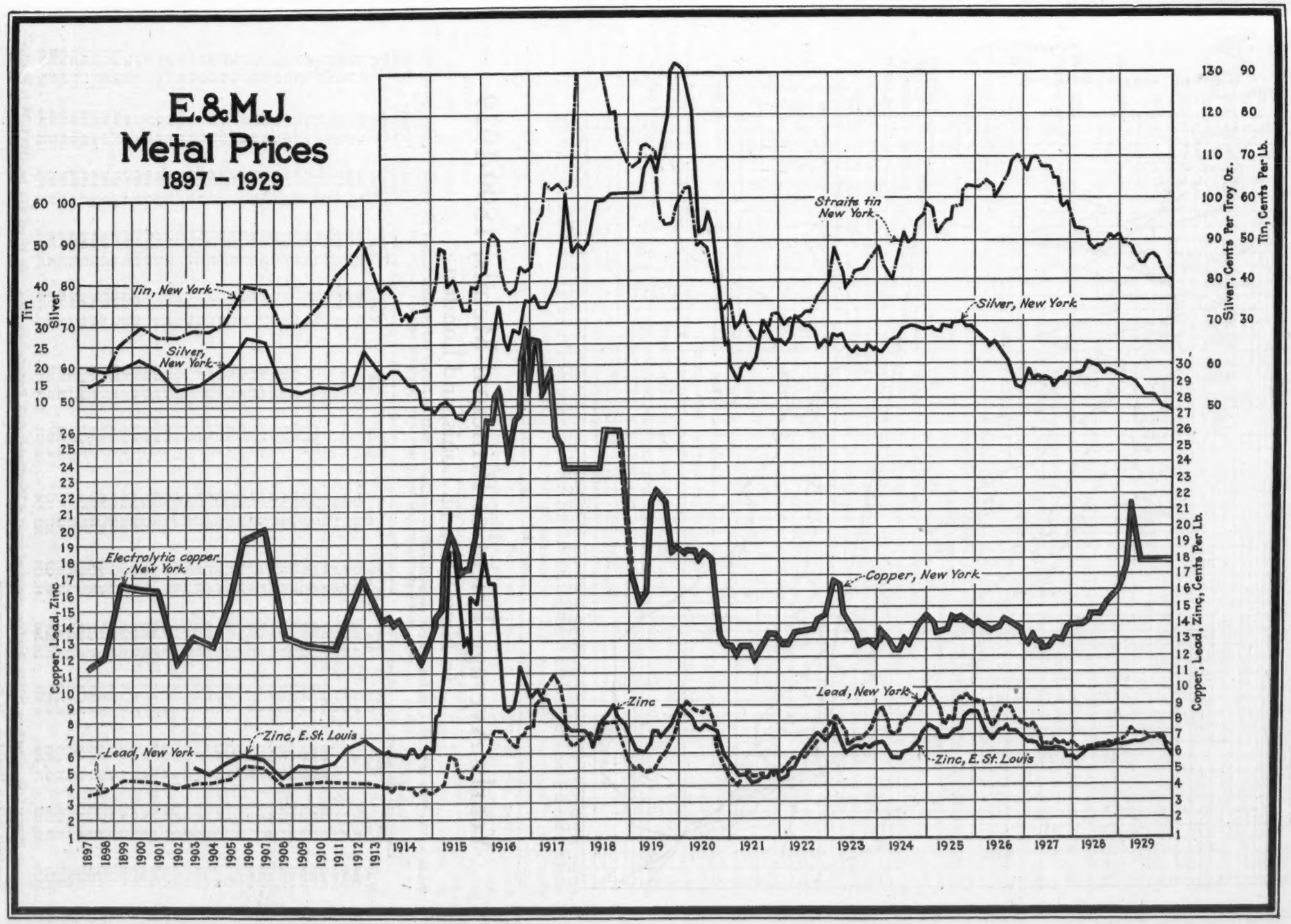
Probably more quicksilver reduction plants were built in 1929 than in any previous year in the history of the industry in this country. Generally speaking, the rotary furnace has been adopted as the standard plant, together with all-metal construction of the furnace, dust precipitators, and the condensing system.



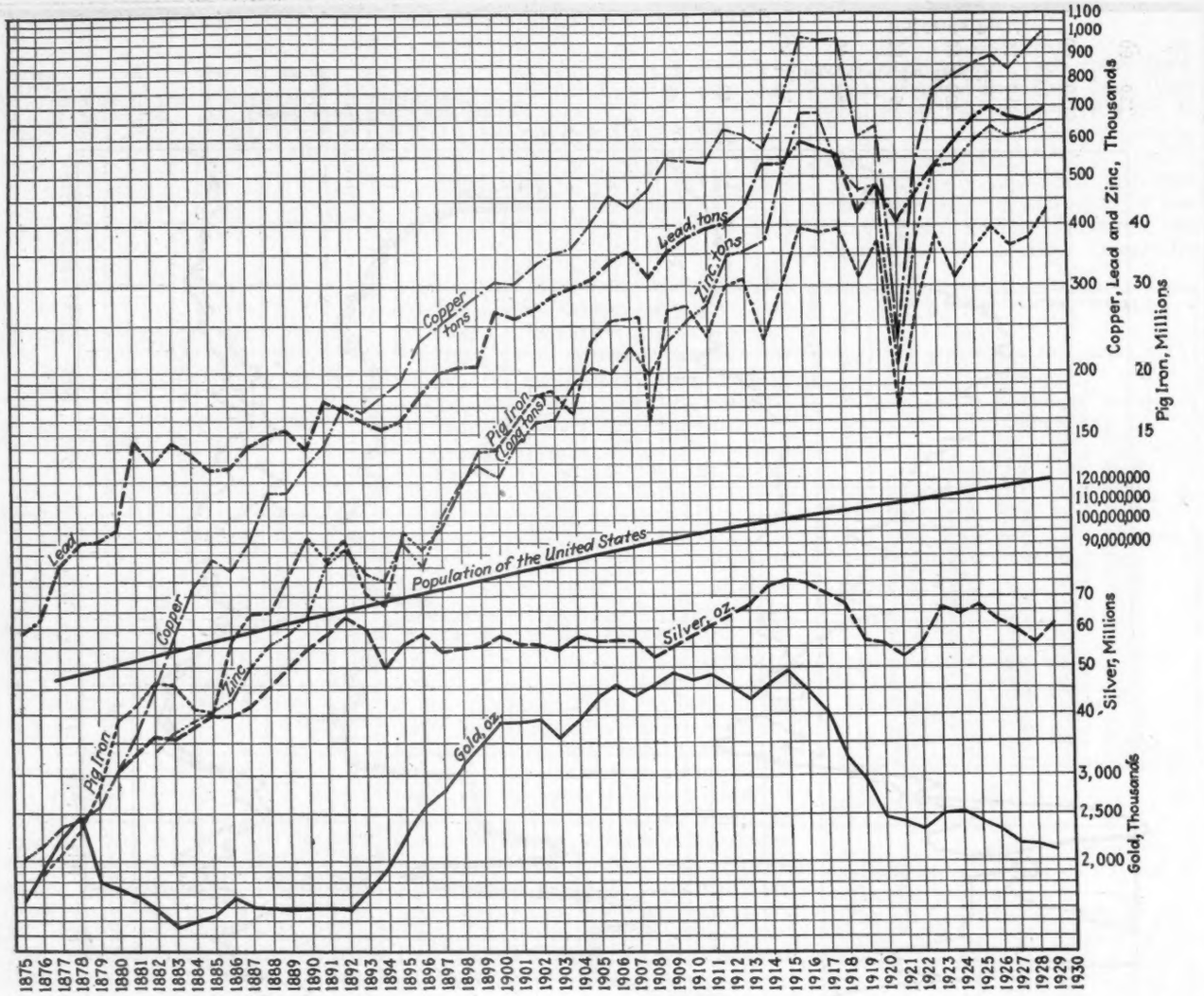
The marketing of quicksilver metal is more satisfactorily handled at the present time than ever before, the so-called quicksilver cartel or trust of the Spanish and Italian producers, who sell through a common sales agency, the Mercurio Europeo, at Lausanne, Switzerland, being the dominating factor. If production in Spain and Italy is restricted to a point where, with American production, it will about meet the world's needs, the price of quicksilver will unquestionably be held at its present high level for at least several years.

This sales organization just recently offered a prize of £5,000 (nearly $25,000) in an international competition to encourage the discovery of new and important uses for quicksilver. It will be interesting to see if this prize brings forth any new uses for the metal. No new use that required any appreciable amount of quicksilver was apparent in 1929, but the fact that an annual increase in consumption occurred was clearly evident.

In a general way, the market situation is similar to its position a year ago, and the present prices will probably continue through 1930 and perhaps for several years to come. Though I do not expect to see a great increase in the American production, I feel that the individual mines will show more profit in 1930 than they have in the past.


E.&M.J.
Metal Prices
1897 – 1929
Tin
Silver
Copper, Lead, Zinc
Silver, Cents Per Troy Oz.
Tin, Cents Per Lb.
Copper, Lead, Zinc, Cents Per Lb.
Straits tin New York
Tin, New York
Silver, New York
Silver, New York
Electrolytic copper New York
Copper, New York
Zinc
Lead, New York
Zinc, E. St. Louis
Lead, New York
Zinc, E. St. Louis
1897 1898 1899 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929

Metal Production of the United States, 1875-1929



Yearly Average Prices of Principal Metals, 1899-1929
in New York, St. Louis, and London

Prices in New York or St. Louis, cents per pound, except quicksilver (dollars per flask), and silver and platinum (dollars per ounce) pounds sterling per long ton, except silver (pence per ounce)

	Copper		Lead		Tin		Zinc		Silver		Antimony,	London quotations, Quicksilver,	London quotations, Platinum,
Year	Electrolytic New York	Standard London	New York	London	(b) New York	(a) London	St. Louis	London	New York	London	New York	New York	New York
1899	16.67	.....	4.47	14.933	25.12	122.429	.....	.....	59.580	27.438	9.430	43.63	15.22
1900	16.19	.....	4.37	16.987	29.90	133.575	.....	.....	61.330	28.250	9.500	51.00	18.09
1901	16.11	.....	4.33	12.521	26.74	118.633	.....	.....	58.950	27.188	8.250	47.00	20.00
1902	11.626	52.460	4.069	11.262	26.79	120.720	.....	.....	52.160	24.090	6.120	48.03	19.00
1903	13.235	57.970	4.237	11.579	28.09	127.320	5.191	.....	53.570	24.750	6.000	41.32	18.91
1904	12.823	58.884	4.309	11.983	27.99	126.733	4.931	.....	57.221	26.399	6.371	41.00	19.50
1905	15.590	69.465	4.707	13.719	31.358	143.083	5.730	25.433	60.352	27.839	10.250	38.50	20.34
1906	19.278	87.282	5.657	17.370	39.819	180.646	6.048	27.020	66.791	30.868	21.730	40.90	28.04
1907	20.004	87.007	5.325	19.034	38.166	172.638	5.812	23.771	65.237	30.188	14.840	41.50	30.98
1908	13.208	59.902	4.200	13.439	29.465	133.124	4.578	20.163	52.864	24.402	8.004	44.84	16.32
1909	12.982	58.732	4.273	13.042	29.725	134.774	5.352	22.185	51.502	23.706	7.466	46.30	24.87
1910	12.738	57.054	4.446	12.920	34.123	155.308	5.370	23.050	53.486	24.670	7.386	47.06	32.70
1911	12.376	55.973	4.420	13.970	42.281	192.353	5.608	25.281	53.340	24.592	7.540	46.54	42.12
1912	16.341	72.942	4.471	17.929	46.096	209.420	6.799	26.421	60.835	28.842	7.760	42.46	45.55
1913	15.269	68.335	4.370	18.743	44.252	201.679	5.504	22.746	59.791	27.573	7.520	39.54	44.88
1914	13.602	61.524(c)	3.862	19.076(c)	34.301	156.564(c)	5.061	22.544(c)	54.811	25.313	8.763	48.31	45.14
1915	17.275	72.532	4.673	22.917	38.590	163.960	13.054	67.533	49.684	23.675	30.280	87.01	47.13
1916	27.202	116.059	6.858	31.359	43.480	182.096	12.634	72.071	65.661	31.315	25.370	125.49	83.40
1917	27.180	124.892	8.787	30.500	61.802	237.563	8.730	52.413	81.417	40.853	20.690	106.30	102.82
1918	24.628(d)	115.530	7.413	30.100	(e)	330.138	7.890	54.180	96.771	47.516	12.581	123.47	105.95
1919	18.691	90.796	5.759	28.590	63.328	257.601	6.988	42.879	111.122	57.079	8.190	92.15	114.61
1920	17.456	97.480	7.957	37.832	49.101	295.866	7.671	44.372	100.900	61.590	8.485	81.12	110.90
1921	12.502	69.356	4.545	22.752	29.916	165.265	4.655	25.845	62.654	36.886	4.957	45.46	75.03
1922	13.382	62.123	5.734	24.097	32.554	159.450	5.716	30.003	67.521	34.406	5.471	58.946	97.618
1923	14.421	65.840	7.267	27.147	42.664	202.148	6.607	33.058	64.873	31.926	7.897	66.502	116.537
1924	13.024	63.149	8.097	34.421	50.176	248.737	6.344	33.728	66.781	33.969	10.836	69.761	118.817
1925	14.042	61.920	9.020	36.429	57.893	260.974	7.622	36.624	69.065	32.088	17.494	83.128	119.093
1926	13.795	57.971	8.417	31.075	65.285	291.016	7.337	34.105	62.107	28.686	15.988	91.903	113.269
1927	12.920	55.653	6.755	24.192	64.353	288.953	6.242	28.513	56.370	26.046	12.393	118.159	84.636
1928	14.570	63.703	6.305	21.060	50.427	227.131	6.027	25.284	58.176	26.746	10.305	123.506	76.580
1929	18.107	75.416	6.833	23.246	45.155	203.850	6.512	24.790	52.993	24.460	8.956	122.145	67.655

(a) Standard tin; prices from 1899 to 1914 from statistical report of Metallgesellschaft, Frankfurt-am-Main. (b) 99 per cent tin, 1899 to 1919; Straits tin 1920 to 1929. (c) Average for nine months, no quotation being made during August, September, and October. (d) Average of eleven months, no quotations being made in December. (e) No average computed.

Minor Metals

Paul M. Tyler

Expanding Output and Consumption Evident Throughout the World

TARIFF MAKING and practical progress in supplanting imports by domestic production in the United States marked 1929 as an important year in the history of many of the minor metals, notably antimony, manganese, and tungsten. As a result of the renewed attention given to American deposits, the outlook for vanadium mines in the United States is better than it has been for many years, and the revival of interest in the exploitation of the carnotite ores of Colorado, Utah, and New Mexico is further indicated by a bill introduced into the House of Representatives by Congressman Clyde Kelly, of Pennsylvania, authorizing the U. S. Bureau of Mines to produce one gram of radium at government expense as a means of encouraging the resumption of this industry, which collapsed as soon as the richer deposits in the Belgian Congo began to be exploited actively.

Chrome mining, though lacking the stimulus of tariff support, showed signs of awakening from the paralysis that came upon it after the armistice. Molybdenum, the one ferro-alloying element that all now agree is abundantly available in commercial deposits within the continental boundaries of the United States, has forged further into favor with the steel makers, and the rapidly growing demand has necessitated large extensions in milling facilities in order to increase the supply of ore. Tantalum, another element that has had to jostle a place for itself, likewise found a larger market in 1929.

Antimony

THE outstanding feature of the antimony industry in the United States in 1929 was the agitation for increased tariff designed to create a domestic smelting industry. In its present form, the draft of the new tariff bill provides duties on antimony regulus, which are designed to stabilize prices. According to a cumbersome sliding scale, the proposed maximum duty is 4c. a pound when the New York price, as quoted for the week preceding the date of arrival, is not over 7c. a pound, and the duties are progressively diminished as the New York quotation advances, until they disappear altogether when the quotation exceeds 14c.

In the event that this duty becomes effective, the two 50-ton furnaces of the Republic Mining & Metals Company (Cookson's) at Wadley, Mexico, are to be dismantled and a new smelter is to be constructed across the border in the United States, probably in Texas. Pending a decision as to the tariff, the Wadley smelter has been operating more or less intermittently in order to retain its organization intact. The new smelter, if built, will draw its ore supply largely from the company's mines in San Luis Potosi, and the present smelter staff, including many of the Mexican employees, will be transferred to the American plant.

During the last few years, gradually increasing amounts of foreign ore have been imported for use in making antimonial lead and for the manufacture of oxide. The latter business will receive a further fillip provided the tariff on oxide is advanced in harmony with that on metal, as now proposed.

These enterprises are projected on the basis of utilizing foreign ore—principally from Mexico and China—which remains on the free list. In the end, however, by stimulating smelting in the United States, they may provide a market for domestic ores. Substantial supplies of antimonial gold ores have been developed in the Yellow Pine district in Idaho, and the newly constructed road into that formerly almost inaccessible region may throw a new light on the domestic ore situation. Experiments conducted in Canada have shown that excellent recoveries of stibnite can be made by selective flotation, so that the former difficulties in the way of utilizing low-grade ores now seem largely to have disappeared.

A study of the physical and chemical properties of the higher oxides of antimony is being conducted at the U. S. Bureau of Mines experiment station at the University of California, Berkeley, Calif. The behavior of these oxides is important in relation to certain problems in refining virgin lead and in working up antimonial scrap lead recovered after use in storage batteries. Although the trioxide of antimony is volatile at relatively low temperatures, the tetroxide is practically non-volatile, and the pentoxide undergoes decomposition with an evolution of oxygen. The inertness and non-volatility of the tetroxide are undoubtedly responsible for the occasionally anomalous behavior of antimony in lead refining.

When the antimony market fails to fluctuate more or less violently, the fact is worthy of note. In 1929, the price of the metal declined quite gradually. The quotation for ordinary Chinese brands, which started the year at 9⅞c., was shaded almost steadily month by month to 8½c. at the end of the year. Following upon a similar unspectacular decline in 1928, the absence of major flurries in 1929 was particularly remarkable.

The consumption of antimony apparently took an upward turn, due perhaps to the absorption by the market of the revolving fund of battery plates and to heavier buying by the railroads. If we can judge from figures for the first ten months, imports of metal were substantially larger than they have been in most previous years, and, although there seems to have been some falling off in imports of ore, the quantity of crude or needle antimony imported was much above the average. The manufacture of antimony oxide in the United States seems established on a firm basis, and the demand has improved, so that the larger capacity is warranted. Manufacturers are now investigating the paint field, with a view to extending the use of antimony pigments.

Bauxite

UTILIZATION of byproducts is the new order in the refining of bauxite. The residual "red mud," containing iron and silica, is being made into ferrosilicon. The next step, perhaps, will be the recovery of titanium dioxide, which the paint trade is demanding in ever-increasing quantities. The mechanical separation of bauxite from its impurities is a difficult problem, but the conditions under which it may be accomplished are set forth in Bureau of Mines Bulletin 312, "Bauxite; Floating and Sink Fractionation Flotation Experiment," by B. W. Gandrud and F. D. DeVaney, which describes investigations made at the Southern Experiment Station of the U. S. Bureau of Mines on the beneficiation of low-grade domestic bauxite.

Imports from British and Dutch Guiana were well maintained, and this appears to be true also of domestic production and consumption.

Germany depends on foreign sources for her supply of bauxite. In 1927, Hungary was the leading source, furnishing 46 per cent of the total imports, but in 1929 (eight months) that country furnished only 22 per cent. France, which supplied only 28 per cent of Germany's imports in 1927, now contributes 38 per cent. Italy and Yugoslavia are both increasing their supply,

and Roumania is expected soon to enter this same market. Production figures for Yugoslavia are not available for 1929, but in 1928 the output dropped by more than 50 per cent, compared with 1927. As is generally known, the French output could be largely increased, as the reserves are extensive and readily accessible. A new turn in the foreign situation may perhaps be forecast, however, by the announcement that Jan Mayen, a Norwegian-owned island in the Arctic Ocean, contains bauxite deposits that may make Norway independent of foreign supplies.

Chromite

PRELIMINARY figures, showing almost as much chromite imported in nine months of 1929 as in any previous twelve-month period, indicate that the fast-growing demand for chromium, which commenced in 1922, took a further sharp upturn in 1929. The uses of chromite are now so diversified that probably no one of them accounts for this continued expansion coming after a long boom period. Wider use of chrome plating in the automobile industry, larger production of chrome-alloy steels (due especially, perhaps, to new applications of stainless iron and steel), and a healthy growth in the sales of chrome refractories and chemicals, all contributed to make 1929 another record year.

Except during the brief period of the World War, domestic production of chromite has been insignificant for several decades. Recently, however, more attention has been given to the development of domestic sources of supply. As chrome becomes a larger and larger factor in our domestic economy, attention is drawn to the fact that our supplies of chrome ore are all obtained from distant sources overseas. In the event of war emergency, this country has demonstrated ability to provide a fairly substantial portion of its requirements from domestic deposits, but the possibility is being considered that a virtual monopoly may once more be established abroad. Such a monopoly, if established, might place the commercial control of chromite supplies in the hands of foreign firms, which, though not unfriendly to the United States, might find it to their advantage to limit the quantities or to advance the prices of material available for American consumption. Relatively few American firms have managed to guarantee their future requirements by the purchase of foreign mines.

California has furnished most of the chrome ore mined in the United States in recent years. In 1929, some work was done with a view to exploring an occurrence of chromite in Georgia and one or two old mines or prospects in Maryland. The Benbow claims, near Columbus, Mont., have been opened, and table tests on ore from this locality were made last October in the new mill of the Ardsley Butte Company, at Butte, Mont. The chromiferous serpentine belt in Sweetgrass and Stillwater counties, Mont., is from 50 to 200 ft. wide and apparently extends for 34 miles, although only its east and west ends have so far been prospected. H. A. Doerner has recently been conducting investigations at the Reno station of the U. S. Bureau of Mines directed toward the utilization of low-grade chrome ores for the manufacture of chemicals. The results of this work, soon to be published, may help to further the development of domestic deposits.

In Rhodesia, which has recently been furnishing about one-half of the world's supply of chromite, production was reported to be at an even higher rate in 1929 than in previous years, and there was a relatively greater increase in the output from South Africa, due in part to railroad extensions and in part to the economy of using this moderately low-grade material (42 per cent), which is offered at a substantial saving in price as compared with standard (48 per cent) ore. What may be the most noteworthy development, however, was in Anatolia. Asiatic Turkey, a leading factor in chrome production in the 'nineties, later declined in importance. Improved transportation facilities and more favorable political conditions have induced several firms recently to seek supplies in this region.

Among technical developments may be mentioned investigations described by Harlow G. Jones, which indicate that the resistance to spalling of chrome brick may be increased by adding diaspore, and conversely that the addition of finely ground chrome ore to diaspore increases its resistance to spalling and also its resistance to slag action. Many chrome ores contain so much iron that they cannot be made into standard grades of ferrochrome. The direct production of chromium steels in the electric furnace, using chrome ore, now promises to provide an outlet for domestic ore having high iron ratios. A Swedish concern is said to have made stainless steels at a relatively low cost directly from chromite and iron ores by the Flodin-Gustavson electric furnace method. The Autochrome process is claimed successfully to convert ordinary iron or steel into chrome alloy by the direct use of chrome ore (mixed with nickel or cobalt chloride). The method was developed in France by the inventors of the Autodoublage process for calorizing iron and steel tubes and doubtless follows somewhat the same lines. According to reports, the chromium penetrates practically through to the center of the article treated.

Manganese

EVEN the threat of losing the tariff failed to prevent domestic manganese producers from increasing their output in 1929. Fear that the steel companies would succeed in their efforts to induce Congress to place ore on the free list, and uncertainty as to finding a market for their concentrates, had a disastrous effect upon the financing of many proposed manganese ventures; but, despite these handicaps, new plants completed or practically completed during the year forecast for 1930 a domestic production of ferro-grade ore never before equaled even in war time. The expectations of new operators must, of course, be discounted, and there may be some difficulty in marketing promptly any such tonnage as can now be produced, but the physical capacity has been attained whereby more than one-third of domestic needs can be supplied from within the borders of the United States.

In 1914, American mines produced 2,635 tons of so-called "high-grade" manganese ore; in 1928, they produced 46,636 tons. Estimates for 1929 range from 50,000 to 90,000 tons. The actual figures will undoubtedly be less than the peace-time record of 98,324 tons in 1925, but it should be remembered that more than one-half of last year's tonnage came from the Domestic Manganese & Development Company's kilns in Butte, Mont., and if this sinter (56 per cent) were reported in terms of equivalent raw ore (37 per cent), as was done in 1925, the figures for 1929 would appear substantially larger.

Steady shipments of concentrates were produced by the pilot mill of the Georgia Manganese & Iron Company (Brunswick Terminal & Railway Securities Company), at White, near Cartersville, Ga. A larger plant completed in November is expected to produce as much as 140,000 tons in 1930. The new mill of the Hy-Grade Manganese Production & Sales Corporation, at Woodstock, Va., also completed before the close of the year, has a capacity of 30,000 tons of concentrates annually. Smaller mills have been built elsewhere in Virginia and Tennessee and in New Mexico, and increased productive activity is reported in California, Idaho, Montana, and other states. Plans to build an initial unit of a large plant utilizing the Bradley process last spring were canceled in view of the tariff situation, and nothing definite has been subsequently announced.

Known reserves of low-grade manganese ore in the United States were increased by more than 100,000,000 tons by announcements as to results of prospecting in South Dakota, Arizona, and Nevada, and processes are said to have been perfected whereby the ores of these states can be made to yield a 65

per cent sinter, which can be sold profitably at under 60c. a unit delivered at Pittsburgh. Workable reserves in the Butte and Philipsburg districts of Montana are now extended by the discovery that rhodocrosite and oxide ores both can be successfully separated from accompanying gangue minerals by flotation. William B. Daly, speaking for the Anaconda Copper Mining Company, announced that semi-commercial mill runs had confirmed laboratory tests made by Coghill, DeVaney, and others at the Rolla station of the U. S. Bureau of Mines, and that the silica in low-grade Butte ores could be reduced from 35 per cent to not over 6 or 7 per cent. The cost is estimated as between $1 and $1.50 a ton, as much as half of which will be met by the lead and zinc concentrates recovered.

After one of the longest debates in the history of mineral tariff legislation, the Senate by a vote of 60 to 18 agreed to retain the present duty of 1c. a pound (22.4c. a unit) on the manganese content of ore and to extend this protection to cover ore containing 10 per cent or more of manganese. Under the present act, ore containing under 30 per cent of manganese is admitted free of duty, and it was shown that imports of this class of manganese-bearing ore had increased to more than 100,000 tons in 1928, as compared with only about 10,000 tons in previous years.

The international situation indicates a continuance of a buyer's market for some years to come. From time to time, there have been rumors that foreign producers of manganese were combining. Early in 1929, it was reported that another plan for a cartel had fallen through because the Russian Ore Trust refused to entertain any agreements for regulating production or allocating markets. Since the surrender of the Harriman concessions, the Soviet government itself has undertaken an ambitious program to expand production both at Tchiaturi and Nikopol and to export as much manganese as possible, in order to obtain foreign credits. Already the number of workmen has been increased to 8,000, and twenty mines and twenty-one washing plants are stated to be in operation. Production in 1928-29 amounted to about 1,200,000 tons; and, although shipments were only 930,000 tons, the export forecast for the current fiscal year is 1,200,000 tons, and that for 1932-33 2,290,000 tons or roughly two-thirds of the world consumption. As a means of disposing of further quantities of manganese, contracts are already reported as completed for the construction of a ferromanganese plant having an initial capacity of 50,000 tons, which will be increased later to 150,000 tons.

South Africa will contest Russian efforts to dominate the world situation. For a long time the Postmasburg deposits were not taken seriously, but during the last year definite progress was made toward adding South Africa to the list of leading producing countries. The Manganese Corporation, Ltd., which recently acquired ownership of the deposits, expects soon to furnish 300,000 to 400,000 tons annually and possibly as much as 200,000 tons in 1930. This company has paid £302,000 to the government of South Africa, as the estimated cost of the railroad, which should be completed next spring. A large tonnage of ore averaging 49 per cent manganese has been proved, and some ore containing as much as 55 per cent can be produced. Mining costs will be low, but railroad freight (estimated at 16s.), ocean freight (20s. 6d.), and other charges incident to delivering the ore to European or American consuming centers may amount to as much as 18 or even 20c. a unit. Power is available near the mines for the production of perhaps 30,000 tons of ferromanganese a year, and advantage may be taken of this fact, provided the saving in freight charges will more than cover the cost of local smelting.

Still another new factor in world supply came to the front last year in northern Africa. The completion of the railway from Bou-Arfa to Oudja will make it possible to export 80,000 to 90,000 tons from Morocco in 1930 and eventually 200,000 or 300,000 tons as other mines come into production. Portuguese Timor, in the Malay archipelago, commenced shipping in the middle of August, and the Baucau Mining Syndicate there expects to produce at the rate of 1,500 to 2,000 tons a month.

With so much new production coming forward, the question arises as to how it all can be absorbed. Agreements have been made for disposing of some of the Moroccan output in France. British contracts cover some of the new tonnage expected from South Africa, as well as a large part of the Indian output. Brazil and the Gold Coast are likewise protected in part by affiliations with consumers. The anticipated expansion of American production is sheltered by a tariff wall. Under these circumstances, unless world consumption increases with extraordinary rapidity, Russia, in order to accomplish her expansion program, may be forced either to secure favorable contractual relations with the steel makers or to cut prices to unremunerative levels.

Molybdenum

TO THOSE who recall the early struggles of molybdenum producers to find a market for their material, especially in the lean years after the war, that consumption now crowds close upon productive capacity is a source of wonderment. Further increases in consumption might result in still lower costs of operation, but production is now on a large scale, indeed. Hundreds of thousands of tons of automotive and other steels are now treated with molybdenum (chiefly in the form of calcium molybdate, or Molyte), but possibly the new order of things is better told by announcement in *Engineering and Mining Journal* last October that a new unit, with a capacity of 700 tons daily, had been completed by the Climax Molybdenum Corporation, and was to come into operation in November. This brings the daily capacity of this Colorado plant to 2,000 tons. Prospecting by the Molybdenum Corporation of America, partly by geophysical methods, has substantially increased known reserves at Questa, N. M.

Considerable quantities of molybdenum have been lost in the slags of lead smelters. Methods for recovering the element from wulfenite and other molybdenum minerals, frequently found in deposits of oxidized lead ores, have been worked out by the U. S. Bureau of Mines station at Salt Lake City. The lead is removed by chloride volatilization, and the resulting calcine is metallized or otherwise treated to yield a salable molybdenum product.

Tungsten

FOR SEVERAL YEARS, by far the larger part of the world's tungsten has come from China, and for quite a few years Chinese tungsten has been sold almost exclusively through one agency, which was able virtually to dominate the world market. In 1929, something happened. Rumor has it that owing to political reasons, the monopoly changed hands, perhaps in March; the U. S. Department of Commerce reported that then the Lang group succeeded the Feng group in control and some hundreds of tons of ore already purchased by the former group were not released for sale. Quite late in the year, both American and European interests, it was understood, were still striving to secure the coveted sales concession. To maintain prices, the local authorities in Kiang-Si have limited production, and consequently export, to 250 tons monthly.

Whether the monopoly passes to Europe or to the United States, whoever obtains it will be in a position largely to dictate world prices. At the beginning of 1929, it was possible to contract for tungsten in China for around $3 a unit, but within a few months the price advanced to around $8, equivalent, after adding duty, to more than $15 delivered in the United States. This sharp advance obviously results in a substantially larger profit to the sellers. At the same time, however, it encourages activity elsewhere. New interest has been awakened in Burma, where

production has been almost at a standstill so long as Chinese ore remained not only abundant but cheap. In the Federated Malay States, likewise, tungsten has been largely neglected because at former prices better profits could be made in mining tin. I heard during the year just closed of efforts to open up new properties in Bolivia, Mexico, and Portugal, but little definite information is available as to developments of consequence outside of China and the United States. The preliminary import statistics, however, show a sudden and quite substantial revival of imports from South America and a resumption of shipments from Australia.

In the United States, there is promise of further increases in the output of domestic mines. In Colorado, the Wolf Tongue Mining Company continued operations; a new producer, the Tungsten Production Company, of which J. G. Clark is president and manager, is reported to have shipped a few cars; and another custom mill was built in Boulder County. The Nevada-Massachusetts Company, operating at Mill City, Nev., had a good year, enlarged its mill, and built a new one near Mina; and a number of smaller operations came into production in Washington, Nevada, Arizona, and California. The most significant domestic news of the year relates to the Tungsten Corporation of America, which enlarged the mill on its newly acquired property at Bishop, Calif., from 120 to 500 tons' daily capacity. The true perspective on this announcement is obtained by multiplying this daily tonnage by the expected yield—about 0.5 per cent tungsten trioxide. At 500 tons a day for 350 days in the year, the indicated output of this one mill is equivalent to about 1,450 tons of 60 per cent concentrate, as compared with a total of only 1,208 tons produced in the entire United States in 1928.

The new tariff bill, both in the draft approved by the House and in the one approved by the Senate, provides for an increase in the duty on ore from 45 to 50c. a pound of metallic tungsten content (from $7.14 to about $7.93 per unit of tungsten trioxide).

The use of cemented tungsten-carbide tools and dies, introduced scarcely a year ago, has advanced rapidly. One grade, containing 87 per cent tungsten carbide and 13 per cent cobalt, is tough, showing a tensile strength by transverse test of 300,000 lb. per square inch, and its compressive strength is 540,000 lb. per square inch. Another grade, containing only 6 per cent of cobalt, is harder but not so strong. At least five brands are now on the domestic market—Carboloy, made by the General Electric Company; Widia, made by the Krupp works; Hastellite, made by the Haynes Stellite Company; Dimondite, made by the Firth Sterling Company, and Strauss metal, made by the Ludlum Steel Company. The new material, excelled in hardness only by the diamond and selling for $450 a pound, is used in both drawing and blanking dies and in cutting tools that will cut not only the toughest alloy steel but also substances that nothing else will cut—glass, porcelain, mica board, and ivory. It is used in stone saws, and fragments of the tungsten carbide furnished by the Stoody Company and other concerns are used instead of bort in "diamond" drilling.

Tantalum

IMPORTS of tantalum ore from Australia amounted in the first nine months of 1929 to 8,258 lb., valued at $10,440, or more than in any previous year for which records are available, except 1927, when 15,119 lb., valued at $20,012, was received from abroad. Domestic production in 1928 amounted to 34,899 lb., valued at $26,332, compared with only 1,100 lb., valued at $378, in 1927. The production figures for 1929 are not yet available, but sales were made from South Dakota and there were attempts to start production in North Carolina. Tantalum is used in laboratory ware and in certain instruments as a substitute for platinum, and it is used also, to a limited extent, as a ferro-alloy. A new use, or projected use, is as a binder for tungsten carbide; tantalum itself does not form carbides.

Uranium, Radium, and Vanadium

NEW INTEREST is being taken in domestic deposits of vanadium ores, and ore buyers have been scouting about the carnotite camps of Colorado and Utah. The Interstate Copartner Vanadium Company built a large mill in Denver for treating custom ore and ore from its own claims in Kirk's Basin, Utah. Shattuck Chemical Company, also of Denver, has likewise been buying ore. The U. S. Vanadium Company, a subsidiary of the Union Carbide & Carbon Corporation, which bought the claims formerly owned by the Standard Chemical Company, has recently acquired adjoining properties in the Long Park district from the Vanadium Alloys Company. A pitchblende mine in Gilpin County, long closed, was also being reopened last year. In Arizona, the mill built near Globe by the E. C. O'Brien Company to treat near-by tungsten ores has been operating on vanadium. Several deposits of vanadinite have been opened up, and at least one of them has been developed to the point where it would seem to assure a substantial supply of good milling ore. Mill concentrates run 16 to 17 per cent vanadium pentoxide. At Wickenburg, in the western part of the state, the United Vanadium Corporation, of Los Angeles, has been operating in a large mineralized area. Peru shipped vanadium ore to the United States, as usual, but the output of Rhodesia and Southwest Africa went to Europe.

Forty grams of radium were disposed of by the Belgian producers in 1928, and according to early reports sales were at an even higher rate in 1929. The exclusive right of development of radioactive elements in Russia is reported to have been granted to the Rjedkij Elementy. There have been several rumors of radium finds in south and southwest Africa, and early last year news came of a definite discovery believed to be of economic importance. A syndicate of Johannesburg financiers investigated the Gordonia pegmatite areas in Bechuanaland, where pitchblende samples had been taken, but after doing a little work abandoned the project. Plans for further exploration of prospects in various parts of British Africa apparently could not be financed. The Mount Painter radium deposits, in Australia, have attracted considerable interest during the last twelve months; a new road was built and development work has been rather actively pushed.

The report of the British Subcommittee on Radium, published early in 1929, tended to encourage the establishment of new radium enterprises to compete with the Belgian organization, which has enjoyed a practical monopoly of the field for a number of years. About the middle of 1929, the English & Overseas Radium Merger, Ltd., was incorporated in London, with an authorized capital of £1,500,000, to be raised by sales of stock. This new concern, according to newspaper reports, is preliminary to a merger of groups controlling radium-bearing properties in Cornwall, South Australia, and Czechoslovakia. The syndicate behind this proposed consolidation has acquired (1) from the Australian Radium Corporation the mines and mining properties and extraction works in the Mount Painter districts in Australia; (2) the mining leases, mines, and plant of the Radium Ore Mines, Ltd., situated on Crow Hill, Cornwall; and (3) various properties at Weipert, Czechoslovakia, from the Argenta Silver Mining Company, a co-operative miners' union, adjacent to the well-known radium mines at Joachimov. Negotiations have been undertaken for the exclusive selling rights of the Czechoslovakian government mines. In addition to producing and marketing radium, the plans include the construction and operation of a radium "hydro," or spa, in the Fal valley, near St. Austel, utilizing the curative waters from a radioactive spring.

Non-Metallic Minerals

Oliver Bowles

Expansion in Demand and Technical Progress Outstanding Features

BOTH AN EXPANSION in demand and technical improvements were outstanding developments in most of the non-metallic industries in 1929. The steady and consistent growth of the preceding year was maintained by the barytes industry. Although faced with a serious overproduction problem, many operators in the feldspar industry were able to assure continued prosperity to themselves in 1930 by the adoption of improved methods and the construction of new milling plants. Fluorspar companies experienced a good year, and a continuance of uninterrupted production is expected in 1930. Toward the close of 1929, the gypsum industry was emerging from the unsatisfactory economic conditions that had prevailed for some time in that industry. Further improvement seems assured this year. Owing to the expansion in the utilization of mica during 1929, an increase in mica mining in the United States is expected in 1930.

Barytes

THE barytes industry is showing a steady and consistent growth, the 1928 production of 269,544 short tons being the highest recorded in the history of the industry, according to figures compiled by the U. S. Bureau of Mines. The value per ton, however, has steadily decreased from an average of $7.85 in 1924 to $6.51 in 1928. Both increase in volume and decrease in price reflect in some measure the growth in mechanization of mining and ore dressing. The barytes industry, notably in Missouri, has been characterized in the past by numerous small mines and pits worked chiefly by hand labor, but these are giving place to large power-shovel operations, followed by efficient mills for washing, screening, and concentration. Such equipment makes it possible to handle a much large volume of material and to effect a better recovery at lower cost. The more modern equipment also furnishes a product better adapted to the needs of consumers.

Another factor in the expansion of the barytes industry is the growing demand for barium products, particularly for lithopone used extensively as a white paint pigment. Barium chemicals are constantly finding wider application. A use that is growing in importance is the addition of small percentages of barium carbonate to clay to prevent the formation of scum in the stiff-mud brick process. The increasing demand is emphasized by the fact that, in addition to rapidly growing domestic production, imports of crude barytes in 1927 and 1928 were 2 to 2½ times as great as in 1925, and the importation of 64,299 tons for the first nine months of 1929 was greater by 2,534 tons than the entire imports in 1928.

Fluorspar

PROSPERITY for the fluorspar industry is dependent in large measure on metallurgical activity, inasmuch as steel furnaces and foundries consume 80 to 85 per cent of the total, and aluminum metallurgy is using increasing amounts. Fluorspar is regarded as an essential in basic open-hearth steel furnaces to keep the slag thin and to make clean castings. Spar for this purpose must contain at least 80 per cent, and preferably 85 per cent, calcium fluoride and generally not more than 5 per cent silica. About 8 per cent of the fluorspar production is used in the glass and enamel industries, for which purpose it must contain from 92 to 98 per cent calcium fluoride and not more than 1 to 3 per cent silica. The balance is used in the manufacture of artificial cryolite (used in aluminum metallurgy), hydrofluoric acid, sodium fluoride, and other chemicals. Acid spar is usually guaranteed to contain not less than 98 per cent calcium fluoride and not more than 1 or 1½ per cent silica.

Over 90 per cent of the United States production is mined in the neighborhood of Rosiclaire, Ill., and in adjoining counties in Kentucky. Small amounts are produced in New Mexico, Colorado, and Nevada. Production costs have advanced considerably during recent years, because the more easily available supplies are depleted, and the mines are becoming deeper. Pumping expense is particular excessive.

Imports have been large during recent years, averaging from 35 to 65 per cent of production. As foreign wages are low and ocean transportation is cheap, competition with the domestic product is keen, particularly in the region east of Pittsburgh. Producers may feel some encouragement from the fact that importations dropped greatly in 1928, the total reaching only 47,183 tons, whereas the 1927 imports amounted to 71,515 tons. For the first nine months of 1929 only 32,525 tons was imported, indicating the probability of a still lower total for 1929 than for 1928. The increase in tariff from $5 to $7.50 per short ton on all fluorspar containing not more than 93 per cent calcium fluoride is no doubt exerting an influence on importations.

One of the most significant recent developments is the great increase in the production of high-grade acid spar, total output being 15,946 short tons in 1928, as compared with 3,748 tons in 1927. This is due to improved methods of flotation concentration worked out by the Franklin Fluorspar Company, partly in co-operation with the Mississippi Valley Experiment Station of the U. S. Bureau of Mines, at Rolla, Mo. This great increase has affected imports of acid spar, which in 1928 were only 3,300 tons, as against 7,500 tons in 1927.

A significant change has also taken place in the uses of fluorspar. Averaging the figures for shipments of domestic fluorspar by uses for the last six years prior to 1928, the fact appears that 87 per cent was employed in metallurgy, about 8 per cent in glass and enamel, and 3.6 per cent for the manufacture of hydrofluoric acid and derivatives. In 1928, the percentage shipped for use in metallurgy dropped to 79.6, whereas the percentage of acid spar more than trebled, reaching 11.4. This change is caused by the increased use of fluorspar in chemicals, particularly in aluminum metallurgy. As most of the acid spar is used by the Aluminum Company of America, which owns the mines of the Franklin Fluorspar Company, it is a fortunate circumstance that the company has been able to develop a process that makes it possible to supply the greatly increased needs from its own mines and mills.

Feldspar

MOST of the feldspar mined is ground to a fine powder and used as a constituent of ceramic bodies. A noteworthy recent advance in feldspar grinding is the movement toward better control of composition of the finished product. Feldspar rarely occurs alone; it is usually associated with 5 to 25 per cent of quartz and with small quantities of hornblende, mica, tourmaline, or other minerals. The percentage of associated minerals may be quite variable

even in the same deposit. On this account the more recently built grinding plants are provided with a series of bins or silos, each containing spar of approximately uniform composition. The chemical composition of the spar in each bin is determined by employing methods of sampling similar to those used for metallic ores at custom smelters. Belt conveyors with poidometers are provided, whereby proportionate amounts may be drawn from several bins and a product obtained that will conform to any desired specifications within the limits of the raw materials. Thus grinders can guarantee composition within much narrower limits than has been possible heretofore.

Another important movement is the recent organization of the Feldspar Grinders' Institute, Inc., the avowed purpose of which is "fostering friendly relations and co-operation among its members and the trade for the promotion of the feldspar industry." At a recent meeting a code of ethics was unanimously adopted designed to abolish or prevent all unfair trade practices and to place each mill on a fair and even footing for the distribution of its products.

Technical improvements, such as continuous tube-mill grinding, air separation, and compressed-air transportation of finished product, will promote continued prosperity for the newer mills at least, but overproduction is a serious problem that the industry must face. Present mill capacity is far in excess of market demands, on which account it is desirable that new and wider uses for feldspar be found. There seems to be no lack of supply of raw material from the numerous mines located in thirteen states.

The foreign situation has little influence on the industry; most of the imports are from Canada, and the cost of transportation precludes importation except to near-by grinding mills, as, for example, at Rochester, N. Y.

Gypsum

TOWARD the close of 1929, the gypsum industry was emerging from the unsatisfactory economic conditions that had prevailed for some time. The improved conditions are the result, in part, of a more accurate knowledge of production and distribution costs, of the standardization of products. and of a realization of the value of co-operative effort. Gypsum plant capacity is greatly in excess of market demands, but this is offset to some extent by a continual widening of the market. The increasing market demands are attributable to two chief causes. In the first place, many economies are being brought about in plant operation, in consequence of which gypsum products are being sold at reduced prices.

A tendency has been noted toward erecting the newer plants near centers of consumption, rather than near the gypsum mines. Thus, large plants for the manufacture of gypsum products are now located at Chicago, Ill.; Detroit, Mich.; Boston, Mass.; Philadelphia and Chester, Pa.; Staten Island, N. Y.; and Portsmouth, N. H. Water transportation of gypsum rock from the mines to all the plants mentioned is an important development in the economic transportation of heavy low-priced materials. These newer plants, in strategic locations, are enjoying some advantage over the less modern plants; some of the latter are finding it difficult to operate profitably. In the second place, gypsum products are becoming more diversified, the newer uses making it possible to utilize gypsum in fields of application hitherto not reached. Among the newer products are various forms of acoustical plastics, sound- and heat-insulating materials, porous light-weight blocks, gypsum lath, partition tile, and various special forms of blocks and panels. Even with these wider avenues for distribution, the recession in building construction during 1929 will no doubt intensify the condition of oversupply and retard production.

Much progress has been made in rotary calcining. Considerable trouble has been experienced at times owing to lack of uniformity either in setting time or plasticity of the rotary-calcined product. A "super-calcining process" is now employed, whereby the material passing through the rotary kiln is sent directly to a tube mill before calcination is quite complete, and without cooling. It is claimed that the heat evolved in tube-mill grinding completes the calcining process, and at the same time any overburned material is rehydrated, giving a uniform product of correct chemical and physical properties. Also, tube milling greatly increases the plasticity.

The utilization of byproduct gypsum at chemical plants is becoming of greater importance. Large tonnages are produced, particularly at phosphoric acid and baking powder plants. Several factories are now in operation manufacturing gypsum products from this byproduct material. The Structural Gypsum Corporation's plant at Linden, N. J., manufacturing plaster, tile, and other structural products, attained normal production capacity during 1929. Such plants are handicapped to some extent because the supply of gypsum at individual chemical plants is more limited than are the supplies from gypsum mines, and the factories cannot reap the benefits of large-scale operation. On the other hand, the raw material is obtained at nominal cost.

Kaolin

AMERICA'S kaolin industry has always encountered keen foreign competition. Foreign clays, particularly the English clays, are of high quality and dependable uniformity in grade. The users in early years became accustomed to them, and it is difficult to induce a pottery manufacturer to change his formula. The World War forced the use of domestic clays, and American producers seized this opportunity to establish a permanent industry. A fair degree of success was attained, for it was demonstrated that abundant domestic clays of high quality were available. Competition is still keen, but producing companies have had enough faith in the future to encourage them to build modern, well-equipped plants. Some of these plants, particularly in the South, are producing clays of high quality and uniformity.

Domestic kaolins from Georgia and Florida are finding wider use each year in the manufacture of earthenware pottery, and they are gradually displacing English china clay in electrical porcelain manufacture. One company has attained distinct success in the development of a bleaching process. The treated product is favorably received as a paper-coating clay.

Kaolin production has been increasing steadily and in substantial amounts since 1924. Sales in 1928, amounting to 496,142 tons, were 9 per cent greater than in 1927, and that the same rate of increase in demand for domestic white clays will be in evidence in 1929 and 1930 seems probable. Ball-clay production is increasing also, but at a slower rate. Imports of kaolin, which had been increasing steadily since 1921, decreased 19 per cent, or 57,205 tons, in 1927 below the figure for 1926, and a further decrease of more than 31,000 tons occurred in 1928. Tentative figures of imports for the first ten months of 1929 show a remarkable decline, of over 30 per cent, compared with the 1928 figures.

Magnesite

DOMESTIC magnesite operations in the United States are confined to California and Washington. Much of the Western magnesite reaches Eastern markets, but it meets with two keen competitors—namely, domestic dolomite and imported magnesite from Greece and other European countries. Dead-burned dolomite is a strong competitor of dead-burned magnesite for refractory uses, though magnesite is usually

preferred for open-hearth furnace bottoms. In the Western states, where dolomite and magnesite are both readily available, the general preference for magnesite for refractory uses has been a strong factor in maintaining its market. The growth and prosperity of the magnesite industry depend to quite an extent on iron and steel production, and, as this is a growing industry on the Pacific Coast, the demand for dead-burned magnesite will probably gradually increase. A pronounced increase in such demand was noted in 1926 and 1927, and it reached a maximum of 45,230 tons in 1928. On the other hand, the demand for caustic calcined magnesite is steadily diminishing, having fallen from 28,470 tons in 1923 to 13,310 tons in 1928. This is largely because of the increasing use of portland cement stucco at the expense of the magnesite stucco.

Inasmuch as no commercial magnesite deposits are situated in Eastern United States, the possible substitution of dolomite for magnesite is of interest, especially owing to the fact that high-grade dolomite is plentiful. Various processes have been advanced for separation of the magnesia from the lime. A successful process is now in use by manufacturers of 85 per cent magnesia pipe-covering, but up to the present time no process has been developed for economic production of magnesia for stucco or flooring. Work is still being done on this problem, however, as indicated by a recent article by Platzmann.[1]

Mica

MICA products are of two distinct types: (1) sheet and built-up mica, used chiefly in the electrical industries, and (2) ground mica, used for the most part as a filler or decorative material. Most of the mica of commerce is muscovite or white mica. Phlogopite, or amber mica, is used in considerable quantities, both in sheet and built-up form. Biotite or black mica, which, until recently, was regarded as of no commercial value, is now being used to a limited extent in ground form.

A great increase in the production of ground mica has recently been noted, and its uses are extending. Although it has long been used for decorative purposes in wall paper, ground mica is now used quite extensively in wall plastics also, the latter application consuming about 1,500 tons annually. A considerable increase has also occurred in the use of ground mica as a surfacing material for asphalt shingles and other forms of roofing.

India still dominates the foreign field, about 60 per cent of our imports being obtained from this source. Madagascar is becoming an important producer of amber or phlogopite mica, which, until recent years, was obtained almost exclusively from Canada. Although the United States production of sheet mica fell off greatly in 1927, some recovery was made in 1928, but no evidence of any great improvement was noticeable in 1929. Foreign competition continues to be keen, both in unmanufactured mica and in mica products. A widespread interest in mica mining prevails, however, and the conviction is gaining ground that the United States could produce a much larger proportion of its requirements of high-grade mica than is being supplied at present. Increasing activity in mica mining is to be expected.

Phosphate Rock

FLORIDA produces about 82 per cent of the total phosphate rock mined in the United States, and Tennessee about 17 per cent, the remaining 1 per cent being produced in the Western states. These percentages vary somewhat from year to year. Total production, however, has not varied greatly in recent years. The 1928 output totaled 3,501,406 long tons, valued at $12,443,179. The export trade has varied from 25 to 29 per cent of production for the last four years. In 1928, 898,764 long tons was exported.

Phosphate rock is produced in many countries throughout the world. The countries of northern Africa—Algeria, Egypt, Morocco, and Tunis—produce about 50 per cent of the world's supply and the United States about 33 per cent, the remainder being produced in more than twenty countries.

American foreign trade and domestic markets are both seriously threatened by foreign production. Although American production maintains a fairly uniform level, foreign production is increasing. The tonnage of phosphate rock produced in the United States, when compared with world production, has gradually fallen from 42 per cent in 1923 to about 33 per cent in 1928. Large deposits of phosphate rock in northern Africa, with their low production costs, are the most serious menace at the present time to United States trade. The precarious condition of this trade is indicated by the fact pointed out by Jacob[1] that Moroccan phosphate has been sold in Baltimore at a lower price than the same grade of Florida "pebble."

Silica

SILICA is a general term covering various forms of quartz. The greatest volume of quartz used in industry consists of sand, gravel, and sandstone, but these industries are so large that they are considered as separate subjects and are not included under the term silica. The forms included under silica are those of somewhat minor importance, such as massive quartz, flint, tripoli, diatomite, ground sand and sandstone, and some special sands. Crystalline quartz is being used more widely for the manufacture of fused quartz products. Quartz glass, on account of its ability to permit the passage of ultra-violet light rays, has recently been used for windows in sanitariums.

Flint finds its chief uses as pebbles for tube-mill grinding and, in ground form, as a constituent of ceramic bodies.

Diatomite is finding wide use for high-temperature insulation. Recently, the plant of the Celite Products Company, at Lompoc, Calif., the largest diatomite producer, passed into the hands of the Johns-Manville Corporation, the well-known manufacturers of asbestos insulating materials. This circumstance is significant in that it indicates a tendency toward the centralization of insulating materials and also a trend toward the utilization of a greater variety of raw materials in the manufacture of insulating products.

Some interest has been shown in a new type of pulverizing equipment recently placed in a mill in southern New Jersey. It is known as a pneumatic pulverizer. It employs opposing jets of superheated steam to force two streams of sand together. It is claimed that the method is successful, that the cost is low, and that the system may be applied to materials other than sand—for example, coal or gypsum.

Two important companies in the Ottawa (Illinois) district have consolidated, the Ottawa Silica Company having purchased the properties of the United States Silica Company. Three mills are operating day and night and are producing very pure sand graded into eight standard types, the coarsest of which is the well-known "standard Ottawa Sand."

Soapstone and Talc

TALC production in the United States has been fairly constant for several years; in 1928 it reached 202,976 short tons, an increase of 6 per cent over the record for 1927, and the largest tonnage since 1924. New York and Vermont are the chief producing states.

The uses of talc are dependent to a remarkable degree on the physical properties of the material as it occurs in nature. Thus, its colloidal character in finely divided form gives it a high retention—an essential property of a paper filler—and its soapy feel makes it useful for cosmetic manufacture. In massive form, its resistance to the passage of heat and its heat retention make it useful in foot-warmers, fireless cookers, and fireplace walls. On account of its high acid resistance, it is useful for

[1] Platzmann, C. R.: "Production of Magnesia From Dolomite." *Rock Products*, Vol. 32, No. 21 (Oct. 12, 1929), pp. 75-77.

[1] Jacob, K. D.: "Phosphate Rock." The Mineral Industry During 1928, p. 479.

lining acid tanks. Its electrical resistance, and its peculiar property of hardening under heat treatment have rendered certain pure, massive varieties useful for the manufacture of the so-called, "lava" products, such as gas tips and electric insulators. Tests have been conducted to ascertain the feasibility of manufacturing synthetic lava products from powdered talc, but commercial success has not yet been attained.

As efficient utilization depends so much on physical properties, a movement is under way toward a more intensive study of the properties of various talcs and soapstones, so that each may be directed to the field where it will give best service. This movement has a sound business basis, for the surest foundation of a broader market is superior service in use.

Pyrophyllite, which is hydrous aluminum silicate with physical properties similar to those of talc, is used in much the same way, and for some uses has advantages over talc. For example, as an admixture for conditioning plaster of paris, used as wall plaster, the absence of magnesium has an advantage in that magnesium salts may cause efflorescence. Talc, being a magnesium silicate, may provide material for such efflorescent salts.

Soapstone, an impure form of massive talc, varies greatly in its physical properties, owing to variations in the nature and proportion of the impurities present. Some forms contain much serpentine, hornblende, or other relatively hard minerals. Such soapstone is found useful for floor tile and stair treads. The chief production of soapstone is by the Alberene Stone Company, at Schuyler, Va. This company has recently purchased the quarries of the Ross & Republic Marble Company, at Knoxville, Tenn., and is now manufacturing both soapstone and marble products.

Ground soapstone and the lower grades of talc are finding quite an extensive market as surfacing material for composition roofing, as tire powder, as a dusting material for coal mines, and for conditioning concrete in the same way as diatomite is used. For this latter use, it is claimed that an amount equal to 4 per cent in weight of the cement used gives good working qualities, effective water resistance, and high strength.

Imports are increasing. For the first nine months of 1929, 1,246 tons of crude and unground talc was imported, as compared with 459 tons for the entire year 1928. Imports of ground and manufactured talc were 27,049 short tons in 1928 and 22,351 short tons in the first nine months of 1929.

Of the world production of talc, the United States supplies 42 to 50 per cent, France 18 to 20 per cent, Italy 8 to 12 per cent, Germany and Austria 3 to 5 per cent, and Canada 2 to 4 per cent.

Nitrate Consumption Increases

FERNANDO BENITEZ

THE OUTSTANDING event in the nitrate year of 1929 was the merger of the Lautaro Nitrate Company, Ltd., with the Anglo Chilean Nitrate Corporation and other firms, the new company formed by the amalgamation having a total capitalization of £14,500,000.

The status of the Chilean nitrate industry, compared with the synthetic, is shown in Tables II and III. Table I shows the amount of Chilean nitrate produced and exported, and the stocks and sales, for the years since 1925. As will be seen from these tables, the world's consumption of nitrogen fertilizers has increased at the rate of about 20 per cent in the last two years, as compared with an average of 5 per cent per year. Though this is highly satisfactory from a producers' point of view, the alarming increase in production, especially in synthetic compounds, more than offsets the buying capacity of the markets. In June, 1929, for instance, accumulated stocks of nitrogen fertilzers were estimated at an equivalent of 2,500,000 metric tons of Chilean nitrate, which compound contains 16.5 per cent of nitrogen. This excessive production can do nobody any good, except, perhaps, the farmers.

Table I—Production, Exports, Stocks, and Sales of Chilean Nitrate

Year	Production, Metric Tons	Exports, Metric Tons
1925-26	2,619,600	2,249,000
1926-27	1,313,400	1,545,600
1927-28	2,547,800	2,868,700
1928-29	3,277,500	2,960,400
	Stocks, Metric Tons	**Sales, Metric Tons**
1926 (June 30)	1,690,400	.....
1927 (June 30)	1,219,700	.....
1928 (June 30)	1,183,600	1927-28 3,145,100
1929 (June 30)	1,714,200	1928-29 2,900,000

As a consequence of the visits to Europe by the Minister of Finance, Sr. Pablo Ramírez, and the Superintendent for Nitrate and Mines, Sr. Delcourt, conferences were held with the European synthetic nitrogen producers, including representatives of the I.G. Farbenindustrie, A.G. The outcome of these negotiations was an arrangement whereby general plans were determined for fixing prices and conducting propaganda for the utilization of the different fertilizers. One outcome of the conferences has been a reduction of about 5 per cent in prices.

The Chilean government guaranteed to the producers of Chilean nitrate for the year 1928-29 a price of 170s. per metric ton of nitrate, provided the producers would not sell under 165s. On account of this bonus, the Chilean government has already paid to the producers about $52,000,000 Chilean currency, or about $6,350,000 U. S. currency, but the total amount to be paid has not been liquidated as yet. The government did not consider continuation of the guarantee of 170s. for every ton of nitrate exported for the year 1929-30 advisable, and has, for this period, as a help to the industry, decided to advance the sum of $30 Chilean currency for every ton of nitrate exported. Besides, a decision has been reached to return to the industry the excess over $150,000,000 (Chilean currency) that the export duties on nitrate and iodine may return to the Chilean exchequer, after deducting the expenses for the Caja de Fomento Salitrero. The import duties for nitrate and iodine for the same period were estimated at $220,000,000 (Chilean currency) in the budget. This means a notable and praiseworthy change of front with regard to the help that the Chilean nitrate industry is receiving from the present government, if compared with the policy followed in the old days; for whereas formerly the main Chilean industry was looked upon as the main source of revenue of the country, today the government considers itself as a co-partner in the industry, from which it receives the considerable sum of $200,000,000 (Chilean currency) a year.

Table II—World Production of Nitrogen

	1927-28 Metric Tons	1928-29 Metric Tons	1929-30 Metric Tons
Synthetic nitrogen products	887,000	1,142,500	1,452,000
Subproducts	396,000	411,500	432,000
Chilean nitrate	395,000	508,500	518,000
Total	1,678,000	2,062,500	2,402,000
Equivalent in Chilean nitrate	10,825,806	13,306,451	15,496,774

Table III—World Consumption of Nitrogen Compounds

	Metric Tons 1926-27	Metric Tons 1927-28	Metric Tons 1928-29
Synthetic nitrogen products	746,000	838,000	1,089,500
Subproducts	315,000	396,000	411,500
Chilean nitrate	276,000	396,500	424,000
Total	1,337,000	1,630,500	1,925,000
Equivalent in Chilean nitrate	8,625,806	10,519,354	12,419,354

Uncommon Ores and Metals

H. C. MEYER

CONSUMPTION and market prices of the so-called uncommon ores and metals, with the exception of titanium oxide, the demand for which continued to increase, experienced slight and unimportant changes in 1929. Beryllium received increased attention, and estimates indicate that as soon as a substantial industrial demand is established for the metal it can be offered at $50 or less a pound.

Beryllium—The most outstanding member of the so-called rare elements is beryllium. Its prominence is not due to any overnight discoveries of its remarkable properties, but is the result of a number of years of patient and careful study and research on the part of a few investigators in the United States and abroad. The metal closely resembles aluminum in its physical and chemical properties. It has a silvery luster, a specific gravity of 1.8, and a melting point of 1,285 deg. C. It does not oxidize at normal temperatures or when exposed to moisture. Unlike aluminum, its future seems to rest on the remarkable properties it imparts to certain of the baser metals when alloyed with them in relatively small quantities. The only ore of beryllium found in commercial quantities at the present time is beryl, a beryllium aluminum silicate. Two grades of this ore are in demand at present, one carrying from 10 to 12 per cent beryllium oxide and the other from 6 to 8 per cent. Important deposits of beryl, some of which are now being worked, are found in the New England states and in South Dakota. Beryl is intimately associated with feldspar, quartz, and other minerals found in pegmatite formations. Deposits of much promise are also known in India, Australia, Brazil, Madagascar, and in Europe. Apparently, vast reserves of raw material from which to produce the element are available. Several hundred tons of beryl, with an average content of 10 per cent beryllium oxide, was exported in 1929. In the first half of 1929 prices ranged from $25 to $30 per ton at mines. To date beryllium metal has been produced only on a laboratory scale, in comparatively small lots. Prices have been correspondingly high, but, as soon as a real industrial demand has been established, estimates indicate that it can be offered, as above stated, at $50 or less per pound. Addition of from 2 to 4 per cent of beryllium to iron is claimed to produce an alloy of remarkable properties. Copper-beryllium and nickel-beryllium alloys also show promise of increasing usefulness.

Cerium—This metal is a member of the rare-earth group including lanthanum, praseodymium, and neodymium—and is the only one for which an industrial application has been found. It is a soft metal with a brilliant, metallic luster, and has a specific gravity of 7 when pure. The melting point is 623 deg. C. Alloyed with iron, zinc, and other base metals, it produces what are known as pyrophoric alloys. These alloys are used in the well-known pocket lighters, as well as other similar devices. Large quantities of ferrocerium were used during the World War, but since then the annual consumption has been comparatively small and has remained nearly stationary from year to year. The material is obtained from cerium residues resulting from the manufacture of thorium nitrate from monazite sand. Cerium metal and ferrocerium are powerful reducing agents, and apparently they offer an excellent opportunity for industrial research. Both the metal and its alloy can be produced at relatively low cost, and abundant sources of raw material are available. Cerium metal sold in 1929 for about $5 per pound and ferrocerium at $6. Fairly large quantities of cerium oxide and rare-earth oxides, which are mixtures of cerium lanthanum and other members of the rare-earth group, are used in the glass and ceramic industries for coloring purposes and for imparting certain optical properties to glass. The oxalate is used for medicinal purposes.

Selenium and Tellurium—These elements are found intimately associated in the slimes resulting from the electrolytic refining of copper. Probably 75 per cent of the selenium produced is used in the glass and enameling industries. The element comes on the market in the form of a black powder about 99 per cent pure. In the glass industry it is used as a decolorizer to neutralize the greenish cast produced by iron compounds in the glass sand. It is also used in conjunction with cadmium to produce ruby glass, which is extensively used in railway signals. Within the last few years, selenium in small amounts has been found to increase the resistance of rubber to abrasion from 50 to 75 per cent. Such rubber is used principally for sheathing portable electric cables. This use suggests that it has possibilities in the automobile tire industry, and some work is being done in this direction. Production in 1929 is estimated as about 300,000 lb. In the first half of the year prices ranged from $1.90 to $2 per pound, and in the last half were reduced to $1.75 and $1.80. The consumption of tellurium was almost negligible. Many attempts have been made to utilize this element, but it still remains a challenge to chemical research.

Thallium—No new uses for this element or its compounds were developed in 1929. Its production is distinctly limited, as it is found only in certain types of ore, principally pyrite, in very small percentages. Such ores, when roasted, produce a certain amount of flue dust, and thallium is extracted from this dust. The element is principally sold in the form of the sulphate, which is used extensively as a poison for such rodents as rats, mice, gophers, and ground squirrels. It has also been used, when mixed with sugar syrup, as an exterminator for certain types of insects, principally black and red ants, for which it is claimed to be very effective. The price of the sulphate in 1929 ranged from $12 to $15 per pound.

Zirconium—Only two ores of zirconia are marketed—namely, zirkite, the natural oxide, coming from Brazil, and zircon, the silicate, which is of more widespread occurrence, important deposits being worked in Florida, India, and South America, where it is recovered from beach sand. A distinct shortage prevailed in 1929 of high-grade zirkite averaging 70 to 75 per cent zirconium dioxide (ZrO_2). Ample stocks of 60 to 65 per cent ore were readily available, however. High-grade lump zirkite sold at $50 to $60 per ton and 60 to 65 per cent lump for about $35 to $40 per ton. The silicate contains from 53 to 65 per cent zirconium oxide and sells in large lots in the unground form at prices ranging from $50 to $65 per ton, depending on the zirconium-oxide content.

Titanium—Rutile and ilmenite are the only commercial ores of titanium. Rutile, the natural oxide, appears on the market in the form of concentrate, averaging about 94 to 96 per cent titanium oxide. Only two deposits are being worked; one is in Virginia and the other in Norway. Ilmenite is much more plentiful, and large deposits are found in Canada and Norway. A substantial tonnage is obtained in the concentration of zirconiferous beach sands in Florida, India, and South America. The massive mineral contains from 30 to 40 per cent titanium oxide, the balance being iron oxide. The black sand concentrates average from 45 to 55 per cent titanium oxide and are preferred to the massive ore. Rutile sold in carload lots at 12 to 15c. per pound in unground form. Massive ilmenite in carload lots commanded about $10 to $12 per ton at the mines. The sand sold for about $15 to $20 per ton. Rutile is used principally in the ceramic industry as a coloring agent, but owing to its cost is rarely used as a source of pure titanium oxide,

ilmenite being used for this purpose, as well as for the production of ferrotitanium. The demand for purified titanium oxide, or titanium white, continued to increase in 1929, as it is superior in many respects to zinc oxide, lithopone, and white lead as a pigment. It appears on the market in the form of the nearly pure oxide and also blended with blanc fixe and zinc oxide. A new product, known as titanium-lithopone, was also marketed in 1929. Competition was keen, and the price dropped from 27c. per pound in the early part of 1929 to 22c. per pound near the end of the year. The pure oxide is also used in small quantities in printing inks and in the glass and ceramic industries.

World Potash Industry Expands

J. W. TURRENTINE

AMERICAN potash production in 1929 was maintained on the higher level established in 1928, when substantial gains were made in total output—namely, from 77,000 tons of potash salts in 1927 to 104,000 tons in 1928. This tonnage, as formerly, is the contribution of two major plants in which the respective raw materials are natural potash-borax brines and distillery waste from alcohol manufacture. The bulk of this production is high-grade muriate, which finds ready acceptance both in the fertilizer industry, for the manufacture of high-analysis fertilizers, and in the chemical industries. In both plants, a mutual interdependence prevails between major and minor products, which fact operates to restrict production, so that expansion in both will doubtless continue to depend on the expansion of the market for the associated products. The expansion in the market for borax, a byproduct of potash manufacture, represented by an increase of 60 per cent in American exportations in 1928, illustrates this principle, and, further, the economic advantage to be gained from byproduct development.

The further expansion of the American potash industry may be anticipated as the result of gradual development and conservative growth. Substantial projects are now under expert examination, from some of which the establishment of new production units may confidently be expected.

Importations of potash fertilizer salts into the United States showed a marked decline in 1929, as compared with the figures for 1928, on the basis of the first nine months of the year. This decline affected all grades of salts in this class and in the aggregate amounted to a decrease from 672,354 tons, valued at $14,805,063, in 1928, to 558,990 tons, valued at $12,692,300, in 1929, representing a decrease of 17 per cent in tonnage and 14 per cent in value. In the same period importations of potash salts for chemical, as contrasted with fertilizer, purposes increased from 47,794,000 lb., valued at $3,028,000, in 1928, to 67,635,000 lb., valued at $4,310,000, in 1929, representing an increase of 41 per cent in both quantity and value.

American prices on all potash fertilizer salts, as announced on May 1, 1929, by the German-French importers, showed an advance of from 10c. to 35c. per ton and were guaranteed against a decline for a period of one year.

In Germany the potash industry in 1929 maintained its high order of activity established in 1928, which was a record year. Further amalgamations have been effected in the industry, with the result that it is now concentrated in only six production groups. Capitalization has been increased, and dividends of 10 to 15 per cent were paid in 1929 by certain groups, despite wage increases of the preceding year.

Sales in the first ten months of 1929 amounted to 1,217,182 metric tons of actual potash (K_2O), as compared with 1,231,607 tons in the same period of 1928 and 1,070,823 tons in 1927. The monthly sales varied from 233,000 tons in March to 77,326 tons in May. Assuming for November and December sales equaling those of the corresponding months of 1928—namely, 82,500 and 107,000, respectively—the total for 1929 would be about 1,407,000 tons, compared with 1,420,000 tons in 1928.

Although for a number of years exportations by German producers have represented a steadily increasing percentage of production, the last fertilizer year showed a marked increase in the tonnage of potash used in domestic agriculture, which fact is explained on the basis of rapid increase in the use of the new highly concentrated complete fertilizer mixtures, such as "nitrophoska"—a compound of potash, nitrogen, and phosphates. The growing popularity of these highly fabricated products has enlisted the interest of the potash producers, who appreciate the economies to be realized in the distribution of the more-concentrated and better-balanced mixtures, as contrasted with the old, more-dilute simples. In fact, the continuing transition of the industry to a chemical basis, as compared with the purely mining basis of its earlier years, is indicated in several other ways, and may be illustrated further by the present stage of development of byproducts, such as, bromine, magnesium chloride, magnesium sulphate, sodium sulphate, sodium chloride, and caustic potash, aggregating a gross profit of about 30,000,000 marks. New and enlarged potash storing and loading facilities have been made available at the harbors of Hamburg and Bremen. Internal prices have remained stationary.

In France, further increases in production have been registered, as indicated by the output of 318,450 metric tons of actual potash in the first eight months of 1929, compared with 258,510 metric tons in the corresponding period of 1928, representing an increase of 23 per cent. This is an average production of 39,800 tons per month, on which basis the year's output would be about 478,000 tons. Further advances have been made in the chemical refining of the crude salts and the recovery of byproducts, notably bromine. Improved storage and loading facilities have been installed at the harbor of Antwerp. A tax on production, amounting to 4,375 francs per ton of actual potash, is now imposed by the French government, proceeds from which are used to educative propaganda to promote the domestic use of potash fertilizers—a policy that is yielding the anticipated results.

Developmental activities have been continued in other countries, notably in Poland, Russia, Spain, Italy, and Chile. Poland's production has not yet reached domestic requirements, which are considerable, whereas Spain, with but minor requirements and with one mine in production and a second under development, has made small foreign shipments. No immediate prospect exists that any of these actual or potential producers will enter the foreign market with important tonnages of potash. To what extent possible governmental subsidies in Russia may be used to overcome natural transportation difficulties as they relate to the Russian deposits, however rich and extensive the deposits may be, remains for future years to disclose.

The potash industry of the world seems, on the whole, to possess an enviably secure economic position. The German-French combine, enjoying the solicitude of the respective governments, not only has appreciative home markets but uncontested foreign trade. Notable advance in scientific agriculture the world over and the trend toward intensive agricultural methods, of both of which artificial fertilization is a *sine qua non*, would appear to guarantee an expanding market for potash. Nations possessing potash resources will doubtless succeed in terminating existing dependence on foreign sources, but the growing needs of other nations not so provided should maintain the market at least at its present high level.

Mining in the United States

S. D. STRAUSS
Assistant Editor

THE REMARKABLE elasticity of the metal mining industry of the United States was conclusively demonstrated in the year 1929. Although in many respects 1928 had been a year of large production, the 1929 figures of output—in volume, not value—show an increase of 11 per cent in copper production; 10 per cent, lead; 19 per cent, iron; 5 per cent, silver; and 4 per cent, zinc. Yet these large increases were achieved without the addition of many new mines or metallurgical plants. Copper furnishes an interesting example. Two concentrators of fairly large size were built and put into operation at the Verde Central and Christmas Copper mines. Three or four old mines were reopened and put into production. No new smelters were built, and the only new refinery under construction did not start handling blister until the end of the year. Yet the output of the metal established a new record.

Probably this ability to expand output within a short time without new construction accounts for the interesting state of affairs shown in the accompanying chart.

For several years, although the United States has increased its actual production of copper, lead, and zinc, its percentage of the world total has declined steadily. New mines in Canada, South America, and Africa have been expanding more rapidly than the United States properties. The result has been that the average student of the metal situation is inclined to feel that the United States will never again occupy the position of predominating importance in non-ferrous metal production it once held. Possibly he is right. Yet, as the chart indicates, by some peculiar coincidence the United States not only increased its actual production of copper, lead, and zinc, in 1929, but also increased its share of the world total.

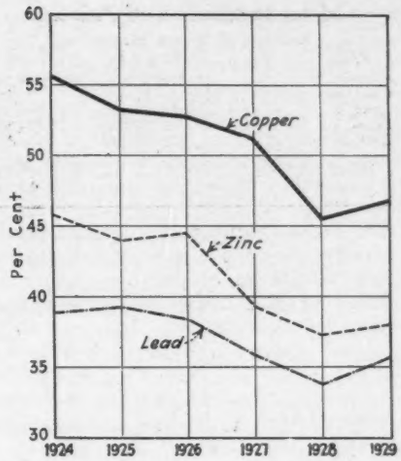
The future is not likely to see a continuation of this increase in copper. The development of Northern Rhodesia makes a drop in our share of the world total an almost inevitable certainty. But the United States mines have not been shelved by any means. Only the United Verde Extension property, in Arizona, and the Kennecott-controlled Alaskan producers are in danger of exhaustion among the large copper mines. Construction of the new Nichols refinery at El Paso, Tex., which was completed during the year under review, is an evidence of the continued growth of the industry. The new plant will treat 100,000 tons of blister from Arizona smelters annually.

In lead and zinc, the position of the United States is complicated by two technical developments that tend to obscure the future. One of these is selective flotation, which is resulting in a gradual shifting of production centers, particularly in zinc. The Western and Eastern sections are displacing the Mississippi Valley mines from their position of predominating importance. This process is an extremely painful one to producers and miners, as indicated by the decline in the zinc price. The other technical development is the growing popularity of electrolytic zinc, reflected in the starting of operations at the Evans-Wallower plant, in East St. Louis, in the fall of 1929. This unit has a capacity of 50 tons of metallic zinc daily, and is the fourth to be built in the United States.

The increase in silver production was caused almost entirely by the increased activity in the other metals. Though small, the decline in gold should be a cause of anxiety. The percentage of byproduct gold is steadily rising, whereas of the real gold mines, only the Alaskan properties are increasing their production. Homestake is holding its own, but gold mines in California, Colorado, and other Western states are becoming scarce.

A review of the progress made in non-ferrous metal mining during 1929, by states and in a fairly geographical order, follows:

Arizona increased its margin over Utah, its nearest competitor among the states in copper production, by a record output of 417,000 tons of the metal in 1929. Not all of the mines shared in this increase, however. Additions to existing plants were undertaken by most of the large producers, so that the potential producing capacity of the state has been greatly enhanced. United Verde, in the Jerome district, remains the largest copper mine in Arizona. Production averaged 6,000 tons monthly in 1929, the maximum reached in any one month being more than 7,000 tons. Operations were severely curtailed later, however, and production is now under 3,500 tons monthly. Sinking of a new main hoisting shaft at this property has become imperative, as ground movement has affected Nos. 5 and 6 shafts, the present operating units. The new shaft will cost between $2,000,000 and $3,000,000 and will be put down near the Verde Tunnel & Smelter depot on the



Percentage of world total produced by United States, shown graphically

Percentage of World Copper Output Derived From U. S. Mines

Year	U. S. Production, (Short Tons)	Percentage of Total
1929	1,011,000	46.8
1928	896,000	45.7
1927	859,480	51.1
1926	865,648	52.9
1925	841,448	53.2
1924	837,107	55.5

Figures are based on U. S. Bureau of Mines totals for domestic refined output. World figures used in computing percentages are A.B.M.S. estimates of world new refined output.

Percentage of World Lead Output Derived From U. S. Mines

Year	U. S. Production, (Short Tons)	Percentage of Total
1929	689,000	35.4
1928	626,202	33.8
1927	668,320	35.9
1926	680,685	38.4
1925	654,921	39.2
1924	566,407	38.9

Figures are based on U. S. Bureau of Mines totals or refined output from domestic mines. World figures used in computing percentages are A.B.M.S. estimates of world new refined output.

Percentage of World Zinc Output Derived From U. S. Mines

Year	U. S. Production, (Short Tons)	Percentage of Total
1929	610,700	38.0
1928	591,525	37.2
1927	576,960	39.2
1926	611,991	44.5
1925	555,631	44.0
1924	515,831	45.9

Figures are based on U. S. Bureau of Mines totals for domestic refined output. World figures used in computing percentages are A.B.M.S. estimates of world new refined output.

Metal Production of the United States

Metal	1929 Amount	1929 Value	1928 Amount	1928 Value
Copper, lb.	2,030,000,000	$367,572,100	1,826,000,000	$266,043,200
Lead, lb.	1,378,000,000	94,158,740	1,252,404,000	78,964,072
Zinc, lb.	1,221,400,000	79,537,568	1,183,050,000	71,302,423
Iron ore, tons.	75,589,000	197,007,000	63,432,826	155,788,657
Gold, oz.	2,128,027	43,990,200	2,233,251	46,165,400
Silver, oz.	60,937,600	32,540,000	58,462,507	34,011,148
Total value		$814,805,608		$652,274,900

Figures for copper, lead, and zinc are derived from U. S. Bureau of Mines estimates, with *E. & M. J.* prices employed in calculating the value. Iron ore figures are entirely from U. S. Bureau of Mines dispatches, whereas gold and silver figures are obtained from U. S. Mint releases.

Metal Production of Arizona

Bureau of Mines Estimate

Metal	Amount	Value
Copper, lb.	833,525,000	$149,200,000
Gold, oz.	.....	4,217,000
Lead, lb.	15,500,000	984,250
Silver, oz.	7,257,000	3,875,000
Zinc, lb.	2,357,000	156,800
Total, 1929		$158,433,300
Total, 1928		114,300,381

300 level. United Verde Extension, rapidly nearing the point of exhaustion, took advantage of the opportunity of disposing of as much of its remaining ore as possible at the high prevailing prices. Output was about 30,000 tons of copper for the year. Verde Central started its new 300-ton concentrator early in the year, shipping concentrate to the U.V.X. smelter.

Miami Copper practically completed its $2,000,000 program of expansion in 1929, and production from its mine at Miami is now about 3,000 tons of copper monthly, compared with 2,000 tons in the earlier part of 1929. Concentrator capacity has been raised to 18,000 tons of ore daily. At its neighbor, Inspiration, an increase was also recorded, although curtailment is now being practiced. Construction of a slime-treatment plant for the oxide unit was undertaken and is practically completed. Old Dominion, which is gradually assuming low-grade large-scale operations, increased concentrator capacity to 1,600 tons daily and added a new 2,250-hp. Diesel to its power plant at Globe.

Of the other copper producers in central Arizona, Magma Copper has launched an extensive program of shaft sinking and development in the No. 5 shaft area at Superior. Lack of underground facilities has prevented increasing production greatly, in spite of excess capacity at the smelter and concentrator. Nevada's Ray mine, near Hayden, made no changes in the scale of operations, and, in fact, production was slightly lower. Christmas Copper, also near Hayden, put a new 400-ton concentrator into operation in June.

Total output from Calumet & Arizona's properties at Ajo and Bisbee will show little change from 1928. An increase at Bisbee was offset by a slight decline at Ajo, where important changes are being made to the New Cornelia concentrator. This plant is being enlarged to a capacity of 15,000 tons daily, so as to handle the entire mine output, as oxide ore reserves are being exhausted and the leaching plant will have to be dismantled. The increase in flotation concentrate from Ajo necessitates additions to the company's smelter at Douglas, and an extensive program of remodeling is under way. In addition, the Junction and Campbell shafts, at Bisbee, are being equipped with electric hoists that will permit mining at greater depths than has heretofore been possible.

The Phelps Dodge organization is also in a state of transition. At its Morenci branch tests will be made on a large tonnage of low-grade ore to determine the applicability of several methods, including leaching, and, at some time in the future, operations at this unit will probably be greatly expanded. During 1929, concentrator capacity was enlarged slightly, and the new drainage tunnel was completed. At the Copper Queen mines, the famous Sacramento pit was shut down after twelve years of operation, and glory-holing of the deposit was started. A new Diesel engine is being added to the power plant, and an anode-casting unit constructed at the smelter at Douglas, preparatory to starting shipments to the new El Paso refinery of Nichols Copper.

Metal Production of New Mexico

Bureau of Mines Estimate

Metal	Amount	Value
Copper, lb.	100,000,000	$17,900,000
Gold, oz.	34,200	707,000
Lead, lb.	22,000,000	1,397,000
Silver, oz.	1,090,000	582,000
Zinc, lb.	68,000,000	4,522,000
Total, 1929		$25,108,000
Total, 1928		18,815,863

Shattuck Denn, after several years of development and equipment of its Denn mine, also at Bisbee, brought that unit into regular production during 1929. At present the output is about 1,500,000 lb. monthly, with prospects of further increases when mining of the Ophir orebody is started. The company is partly interested in the 79 Lead-Copper mine, near Hayden, which became the largest lead producer in Arizona during 1929. At Ruby, Eagle-Picher Lead was somewhat hampered in milling because of lack of water.

Within the next two or three years, Arizona may look forward to the addition of two new copper mines that will serve to offset the loss of the U.V.X property, when it is exhausted. One of these, the Bagdad, has been handicapped by lack of transportation facilities, but this difficulty is said to have been solved. At present, test metallurgical work and considerable development are under way on the property, near Hillside, Yavapai County. The deposit is said to resemble other low-grade porphyry mines in the Southwest, and production, when it is started, will be on a large-tonnage basis. The other property referred to is Zonia Copper, near Kirkland, where a 600-ton leaching plant is under construction.

Two properties—the Chino mine of Nevada Consolidated and the Pecos mine of American Metal—were responsible for most of New Mexico's metal output during the year under review. At Chino, mill capacity has been raised to 15,000 tons of ore daily, but after the spring the plant participated in the general curtailment of output among copper producers. Nevertheless, Chino's output showed a gain for the year, though the exact quantity is not known, inasmuch as Nevada Consolidated does not release statistics for its individual properties. New Mexico's production of copper showed a total gain of 5,000 tons over the record for 1928, in spite of decreased shipments from Lordsburg, the only other important producing copper camp. At the Pecos lead-zinc mine, operations showed a gain in lead concentrate production, with about the same tonnage of zinc. Since the close of the year tonnage has been cut from 600 to 300 tons daily because of low zinc prices. Development has shown existence of a third orebody, known as the Cucaracha, at the property. Preparations are being made to develop it at depth.

Metal Production of Colorado

Bureau of Mines Estimates

Metal	Amount	Value
Copper, lb.	8,352,000	$1,495,008
Gold, oz.	211,381	4,369,632
Lead, lb.	49,751,000	3,159,189
Silver, oz.	4,323,387	2,308,689
Zinc, lb.	59,312,000	3,944,248
Total, 1929		$15,276,766
Total, 1928		16,375,355

For several years much has been written in the Colorado press about the possibilities of reviving the state's mining industry, which has been declining steadily. During 1929, some progress was made in the direction of rehabilitation, particularly in the San Juan Basin. An encouraging feature is the trend toward large-scale operation. Additions were made to the three largest mills in the state—Climax Molybdenum brought concentrator capacity up to 2,000 tons daily; Sunnyside, U. S. Smelting's complex-ore subsidiary, handled a record tonnage at its flotation plant, recently enlarged to 1,100-ton capacity; and Golden Cycle added a 200-ton flotation unit to its 1,000-ton cyanide plant at Colorado Springs. Three important new plants were built—a 600-ton underground concentrator at Belden, constructed by Empire Zinc, New Zersey Zinc's Western subsidiary; the 300-ton Shenandoah Dives flotation plant to treat lead-copper ore near Silverton; and the 150-ton Vertex mill, also near Silverton, which will handle silver-gold ore from the Buffalo Boy mine. These improvements augur well for the future. On the other side of the ledger is a continued decline in Leadville's output; curtailment of work at Rico because of inadequate transportation facilities; a drop of almost $500,000 in Cripple Creek's gold production; and the certain knowledge that low zinc and silver prices will cause suspension at many small mines and curtailment at some of the larger properties.

Utah Copper's increased production overshadowed all other developments in Utah in 1929. Completion of electrifica-

tion of the mine at Bingham Canyon; operation of the new precipitation plant; and a copper output that established a new world mark for other mines to equal were the outstanding achievements of the year. Mill capacity at this gigantic property has been brought up to 60,000 tons daily, although by sacrificing efficiency an even larger tonnage can be handled. With the record copper output of about 300,000,000 lb. —which compares with the previous record of about 293,000,000 lb. set by Anaconda in 1916 — Utah Copper's silver and gold outputs were naturally increased.

Utah dropped a little further behind Idaho in the contest for second place among lead producers. At Park City, Park Utah Consolidated shipments showed a substantial drop in tonnage. Development work at this property has not opened up new ore as rapidly as expected. In contrast, Silver King Coalition, which made extensive changes in its flotation plant, increased production and took first place among Utah lead producers. New Quincy, a small producer in 1928, more than tripled its output in 1929 to become the third largest shipper in the camp.

Metal Production of Utah

Bureau of Mines Estimate

Metal	Amount	Value
Copper, lb.	320,193,000	$57,314,000
Gold, oz.	230,580	4,803,000
Lead, lb.	286,817,000	18,213,000
Silver, oz.	17,749,000	9,478,000
Zinc, lb.	100,400,000	6,677,000
Total, 1929		$96,485,000
Total, 1928		79,259,000

In the Tintic district, North Lily shipped an average of sixteen carloads of ore a week to increase its silver-lead production. Tintic Standard also showed a gain. The company's Eureka Standard mine was put into condition for large-scale production, to start in 1930. This property promises to be an important gold mine, its ore being chiefly valuable for the precious-metal content. Chief Consolidated and its subsidiaries, Plutus and Eureka Lilly, did not fare so well from a production standpoint, though development resulted in several interesting discoveries. Early in 1929, U. S. Smelting acquired the entire holdings of Bingham Mines in the Tintic and Bingham districts. The properties at Bingham were thereafter operated in conjunction with the United States mine. Low zinc prices toward the end of the year affected production from this district, and as a whole the Bingham lead-zinc operations did not share in the expansion that marked the area's premier copper mine. The Bingham Prospect mine was the only property to make a marked increase in output.

Nevada's copper production actually decreased in 1929, higher prices notwithstanding. Closing of the Mason Valley smelter, at Thompson, and of the mines at Mason was responsible for a large part of the decrease. The Ely district is now the only important copper-producing center in the state. Nevada Consolidated, the largest operator, completed changes at its concentrator that raised the effective capacity of the plant to 18,000 tons of ore daily. A Cottrell plant was added to the smelter. Mining operations of the company were hampered somewhat by the pending litigation with Consolidated Coppermines, its neighbor, concerning underground mining. Coppermines showed a substantial increase in output, and, by intensive development work, added greatly to its known ore reserves. Low silver prices were reflected in the decreased production of the metal from most silver mines, although the Tonopah district actually showed a small increase. Gold output declined also, but possibilities of an increase in the state's production of the metal are good, as several promising properties are under development in the western section of the state. American Smelting & Refining's Elkoro property, at Jarbidge, is increasing production. Starting of operations at the 300-ton Tybo concentrator of Treadwell Yukon early in the summer helped to increase the state's output of lead and zinc. This property is now the largest lead producer and second largest zinc producer in Nevada.

Metal Production of Nevada

Bureau of Mines Estimate

Metal	Amount	Value
Copper, lb.	131,967,000	$23,622,000
Gold, oz.	156,121	3,251,000
Lead, lb.	16,467,000	1,046,000
Silver, oz.	4,582,000	2,447,000
Zinc, lb.	14,082,000	936,000
Total, 1929		$31,302,000
Total, 1928		31,033,776

Copper was the bright spot in California's mining industry in 1929, for gold output showed a serious drop, and lead and silver were in the doldrums. Although the consolidation of the Empire and North Star mines, at Grass Valley, under the ægis of Newmont Mining, helped to stimulate production and development in that important gold-producing center, decreases were reported by nearly all the other precious-metal camps in the state. The repairs necessary at the Kennedy mine, near Jackson, to put the property back in production after the fire in 1928, were not completed until midsummer. Installation of a larger hoist at the main shaft may aid in increasing the tonnage mined at this property next year. No large new gold mines were added to the list of producers. Mountain Copper, which reopened its Iron Mountain property, was an important factor in the increase in copper production. A 350-ton flotation mill and a 300-ton cyanide plant are now in operation on copper-gold ore from this mine. Development work disclosed additional orebodies of higher than average grade at the Walker Copper mine, justifying an increase in mill capacity from 1,200 to 1,600 tons daily. The higher copper price increased the company's profits to the extent that it was able to discharge all indebtedness.

Metal Production of California

Bureau of Mines Estimate

Metal	Amount	Value
Copper, lb.	33,355,500	$5,952,700
Gold, oz.		8,392,800
Lead, lb.	1,274,000	80,900
Silver, oz.	1,066,100	569,300
Total, 1929		$14,998,700
Total, 1928		15,381,783

Continued recession in production foreshadows the approaching exhaustion of Alaska's bonanza copper deposits, and the search for new mines is becoming more active. In the Nizina Valley, Kennecott is exploring the Nelson prospect. Alaskan mines produced 1,000,000 lb. less copper in 1929 than in 1928, despite higher prices and increased production elsewhere. Of a more cheerful aspect is Alaskan gold mining. Alaska Juneau, probably the lowest-grade lode mine in the world, made a brilliant record for costs and profits, as well as a slightly higher production. Its net income of $1,150,000 was obtained from extraction of about 4,000,000 tons of 90c. gold ore. Fairbanks Exploration was responsible for a large part of the increase of $1,000,000 in Alaska's gold production. Two new dredges were added to the fleet of this subsidiary of U. S. Smelting, making a total of five units in operation, with two more on order.

Metal Production of Alaska

Geological Survey Estimate

Metal	Value 1928	Value 1929
Copper	$5,965,000	$7,233,000
Gold	6,845,000	7,748,000
Silver	266,000	240,000
	$13,076,000	$15,221,000

Some production of lead, tin, and platinum was also reported but exact data are not available.

Only small operations produced in Oregon, the state's output rising in value from $296,000 in 1928 to $529,000 in 1929. Washington's production was also small. In the much-discussed Metaline Falls area, Grandview Mines started a new 250-ton lead-zinc concentrator, which produced regularly throughout the year. Low prices for zinc, and the possibility of a tariff that will hinder joint development of the deposits in this district—which lies astride the United States-Canada boundary—make its future at the moment dubious, although no change has been announced in the official program of Pend Oreille Mines & Metals, which plans construction of a 2,000-ton concentrator and a 100-ton electrolytic zinc plant.

Metal Production of Idaho

Bureau of Mines Estimate

Metal	Amount	Value
Copper, lb.	4,888,000	$874,950
Gold, oz.	.....	403,100
Lead, lb.	304,230,000	19,318,600
Silver, oz.	9,535,000	5,091,690
Zinc, lb.	99,100,000	6,590,150
Total, 1929		$32,278,490
Total, 1928		26,667,706

Idaho mines enjoyed a substantial year. The slight rise in lead prices stimulated activity in the Coeur d'Alene district, and the first complete year of operations at the new Sullivan electrolytic zinc plant was marked by a large gain in the state's output of that metal. Reopening of the Star mine was completed and production gradually increased, the mine being the chief source of supply for the new plant. In addition, several small mines, notably the Dayrock, Sherman, Sidney, Sunshine, Golconda, and Jack Waite, made good gains in production. The Sunshine property, in spite of low silver prices, ranked as the second largest silver producer in the state. Development has resulted so favorably at depth that plans for further increases in capacity to 500 tons daily have been formulated. The three principal Coeur d'Alene mines, Bunker Hill, Hecla, and Morning, maintained production at about the same level as in 1928. The entire Bunker Hill output will hereafter be treated at the company's smelter and refinery, and changes to increase capacity are being made. No new producers were brought in during 1929 in this district, but construction of a 250-ton concentrator was started at the Little Pittsburg mine. From a production standpoint, 1929 was the best year the district has enjoyed since the war. Even after twenty years, the comment made in the 1909 issue of *Mineral Industry*, that the "lead mines of the Coeur d'Alene district have apparently passed their zenith," has not yet been justified. In 1909, production was 97,000 tons of lead; in 1929, about 148,000 tons. Outside the Coeur d'Alene, a new 250-ton concentrator was started by Bunker Hill at the Hall-Interstate property, but the water supply was inadequate and operations were intermittent.

The largest production of copper from the Butte mines since 1916 was the feature of operations in Montana in 1929. Through its purchase of the Clark holdings in 1928, Anaconda Copper now owns all important producing copper mines at Butte except East Butte and North Butte, which was reopened during the year. At one time in the spring, Anaconda was producing copper from the Butte mines at the rate of 1,000,000 lb. daily, but with the let-up in demand, operations were gradually curtailed and several units were closed. An unusually large program of development was undertaken, to minimize unemployment. North Butte gradually increased its output from the Granite Mountain mine to about 300 tons daily. The company is also reopening the Main Range mine. Outside Butte, two properties, the Block P. mine of St. Joseph Lead, and the Spring Hill mine of Montana Mines, attracted most attention. A new 400-ton concentrator was started on lead-zinc ore early in the year at the Block P. property, now the state's largest lead producer. The Spring Hill plant was changed from cyanidation to flotation and preparations were made to increase capacity from 200 to 400 tons of gold ore daily.

Metal Production of Montana

Bureau of Mines Estimate

Metal	Amount	Value
Copper, lb.	298,600,000	$53,450,000
Gold, oz.	.....	1,054,200
Lead, lb.	39,500,000	2,508,250
Silver, oz.	12,650,000	6,755,000
Zinc, lb.	169,660,000	11,282,000
Total, 1929		$75,049,500
Total, 1928		55,365,249

At the Homestake mine, still the premier gold producer in the United States, ore developments during 1929 were satisfactory both as to volume and grade. The usual tonnage of ore was handled, and production was about $6,500,000. Driving of a long adit at the Trojan group, near the Homestake, in South Dakota, was continued.

The Platteville district, in Wisconsin, is still declining in importance, and production of blende was 5,000 tons less in 1929 than in 1928. The Tri-State district, which had also been losing ground for several years, increased production substantially. Production of lead and zinc concentrate from the district to the value of $35,057,970 compares with $31,424,700 in 1928. A tendency to adopt large-scale production as a panacea for the ills of the producers in these days of uncertain zinc prices has become evident in the Tri-State area. Instead of building a small mill as each 40-acre lease is opened up, producers are now erecting large plants of all-steel construction to treat ore from several properties. Commerce Mining & Royalty, St. Louis Mining & Smelting, and Interstate Zinc & Lead have constructed large mills recently. Canam Metals, the company which acquired several Tri-State properties late in 1928, including the Childress holdings, was the most important new factor in the district's production. Commerce Mining & Royalty continues to be the largest individual producer. A new 3,750-hp. Diesel engine is being added to the company's Diesel power plant.

In the southeast Missouri lead field, the most important move of 1929 was the acquisition of the entire property of Desloge Consolidated, large independent operator, by St. Joseph Lead. The old Mine la Motte was reopened early in the year by the same company, and

Tri-State Concentrate Output

	Tons Zinc	Tons Lead	Value Both
Oklahoma	389,515	63,875	$22,274,810
Kansas	210,666	35,187	12,169,370
Missouri	12,361	1,441	613,790
Totals	612,542	100,503	$35,057,970

produced regularly. The Desloge-St. Joseph merger leaves only two large producing interests in the district, St. Louis Smelting & Refining being the other. Production increased slightly in 1929 over 1928, although for the last two months of the year the St. Joseph properties were placed on a curtailed basis of 15 per cent.

The Michigan copper district was not able to take full advantage of higher copper prices early in the year, because of a tight labor situation. Later, when curtailment was the fashion, production was not cut quite as much as at other camps, and the total for the year shows a small increase over the record of 1928. The Seneca and Quincy properties were reopened during the year, and both produced small quantities of copper, though development was the chief work under way. All the established producers undertook development work at various properties, but no important discoveries resulted. Mohawk has unwatered the Michigan property, which will be used to replace the declining production from the Mohawk mine. Production for the entire district in 1929 is estimated at about 185,000,000 lb.

In the Ducktown region, and neighboring areas in North Carolina, the copper market caused a determined search for new copper mines. The Fontana mine, in North Carolina, opened up in 1928, produced at the rate of 250 tons of smelting ore daily. Tennessee Copper increased production slightly and is planning intensive development.

Production from the Mascot Zinc mine, also in Tennessee, was about the same as in 1928. Development of new properties in this district, however, indicates an increased zinc output for the state in 1930. United States Steel is building an 800-ton concentrator at the Universal Exploration property, 14 miles from Mascot, that can, if necessary, be brought up to a capacity of 2,400 tons daily. Adjoining the Universal Exploration, American Zinc, Lead & Smelting, which operates the Mascot, has been developing the Jarnagin lease, from which shipments will be made to the Mascot mill.

St. Joseph Lead has been active in St. Lawrence County, N. Y. The output of the Edwards 600-ton zinc concentrator was slightly higher than in 1928. At the Sylvia Lake property, near by, a 500-ton mill has been erected that will also produce zinc concentrate.

For data on production of quicksilver, other minor metals, and non-metallics, the reader is referred to the separate articles on those products.

New Record Output in Canada

S. J. Cook

IN 1929, for the fourth year in succession, the mining industry of Canada reached a new high record of production. Gains of $18,200,000 in the value of copper and nickel output, $5,500,000 in the production value of structural materials, $2,000,000 in the value of lead and zinc, and a $1,000,000 rise in asbestos output, were high lights in Canada's greatest mining year, when the total output was valued at $303,876,000, or 10.5 per cent more than the valuation of the previous year's production.

New records were established in 1929 in the output of asbestos, cement, clay products, copper, gold, gypsum, lime, nickel, petroleum, salt, stone, sand and gravel, and zinc. The total increase in the value of the mineral output in Canada in 1929 as compared with the figures for 1928 was $28,887,000.

Metals, as a group, showed the greatest gain, with a total valuation of $151,327,000, compared with $132,012,454 in 1928. This was a gain of $19,315,000, or 14.63 per cent. Fuels valued at $76,116,000, as compared with $74,413,160 in the preceding year, showed a net gain of 3 per cent, or $1,703,000. Other non-metallics, including asbestos, feldspar, gypsum, mica, quartz, salt, talc, and soapstone, had a value of $21,205,000, compared with $18,826,692 in 1928. The gain made in this group was 12.6 per cent, or $2,378,000. Structural materials, including brick, tile, cement, lime, stone, and sand and gravel, were valued at $55,228,000, compared with $49,737,181 in 1928, and showed a gain of 11 per cent, or $5,491,000.

Fourth in lead and copper and sixth in zinc among the mineral-producing countries of the world, Canada is already an important source of these primary metals. Moreover, the rise in Canadian production during these years has been so marked as to focus attention on this outstanding development and to cause some speculation as to the effects on world trade that are likely to result from this tremendous expansion. Silver-lead-zinc ores are found in both eastern and western provinces; copper-gold ores are found in the west; copper-zinc ores in Manitoba, Ontario, and Quebec; and in the Sudbury district of Ontario are the great nickel-copper deposits. Moreover, although production data indicate the extent of Canada's contribution of these metals, geological reconnaissance and active prospecting, followed by practical development of promising areas, have indicated a great potential wealth. In this branch of Canada's mining industry phenomenal advances may be expected for many years.

Copper production in 1929 of 242,401,609 lb., valued at $43,362,000, was an advance of 19.5 per cent in quantity and 51.6 per cent in value over the total of 202,696,046 lb., valued at $28,598,249, in 1928. The increase in copper output in eastern Canada is indicated by the production figures of the last two years for the several provinces. In 1928, British Columbia produced 102,283,210 lb.; Ontario, 66,607,510 lb.; and Quebec, 33,697,949 lb. Copper production of British Columbia in that year exceeded the combined production of Ontario and Quebec. For 1929, corresponding figures were: British Columbia, 102,926,632 lb.; Ontario, 84,105.632 lb.; and Quebec, 55,369,345 lb. Ontario and Quebec together produced more copper than British Columbia in 1929. Although predictions are frequently of doubtful value, especially when they have reference to production within a short period, a careful canvass of available data, interpreted in the light of current reports, indicates immediate and considerable advances in the output. of copper. It is probable that the 1930 production will reach 290,000,000 lb.

Public interest in nickel production continued unabated in 1929, and the establishment of large industries proceeded in the Sudbury district. Although a great amount of development work was carried on in this area during the year, production was not allowed to decline, but, on the contrary, was increased. The output of nickel in 1929 was 109,200,000 lb., valued at $25,700,000, or a gain of 12.8 per cent in quantity and 15.2 per cent in value, compared with the record for 1928. At present an extensive development program is under way at Sudbury; mining, smelting, and refining facilities are being extended; and new subsidiary plants are being built. For instance, a plant for the manufacture of acid sodium sulphate from the natural sodium sulphate obtained in western Canada is being erected. The Sudbury district is likely to become one of the great industrial centers of the Dominion within the next few years. In a recent address, G. C. Bateman, secretary of the Ontario Mining Association, speaking of the development of the Frood mine, at Sudbury, said: "When the mine gets into full production about the end of next year—that is, when stoping begins—production of 45 days will equal the production of the last 45 years."

Lead production of 327,062,151 lb., valued at $16,551,000, was a decline of 3.3 per cent in quantity but a gain of 6.4 per cent in value, in comparison with the figures for 1928. By far the greater part of the lead shown in Canadian mineral production records is derived from mines in British Columbia, but some is also produced in the Yukon, Quebec, and Ontario. Certain Canadian lead producers enjoy the benefits of low production costs, and, although the output for 1929 was less than that for the preceding year, the decline does not indicate inability to produce but rather a desire to maintain a sound, economic position in the production of this metal. The position of lead appears to be statistically sound. It is probable that Canada's output of this metal, although less in 1929 than in 1928, will increase in 1930, and that production toward the end of 1930 will be at the annual rate of about 180,000 tons per year.

Zinc production of 204,621,300 lb., valued at $11,009,000 (on the basis of London quotations), was a gain of 10.8 per cent in quantity and 10 per cent in value compared with the totals for 1928. As in the record for lead, most of Canada's zinc is derived from mines in British Columbia, but Quebec and Ontario also produce appreciable quantities. The 1929 output of zinc established a new record, but, owing to lower prices, the value was not quite up to the total for 1926, when the London price averaged 7.41c. for the year. Although some apprehension prevails as to an overproduction of zinc in the world, producers are hopeful that new markets will correct this condition and that within the year the situation will be considerably improved. The expectation is that Canada's output of zinc in 1930 will be close to 118,000 tons.

Platinum and related metals were produced from the nickel-copper ores of the Sudbury district, and the 1929 output of cadmium at Trail, B. C., exceeded that of the preceding year.

Canada's gold output attained a new high record in 1929, displacing that of 1928. The gain, both in quantity and value, was 1.2 per cent. In Ontario, the output from the Porcupine area was slightly below the total for 1928, but production from the mines in the Kirkland Lake district increased to such an extent that Ontario's output for 1929 was higher than that in 1928, the total being 1,606,000 oz. Total production of Canada was 1,914,920 oz., valued at $39,585,000. Less gold was produced in British Columbia mines in 1929, but increased outputs were reported from Quebec, Yukon, Manitoba, and Nova Scotia. A large part of the gold from Quebec was obtained from blister copper produced at the Noranda mine, at Noranda, Quebec. The other principal producers of gold in this province were the Siscoe, Tetreault, and the O'Brien-Cadillac.

In Ontario, the five leading gold pro-

ducers, in order of production, were: Hollinger, Lake Shore, Teck-Hughes, McIntyre, and Dome Mines. Production at each of these properties continued fairly steadily throughout the year. Interest centered in the development work at Teck-Hughes and the research work by McIntyre. Toward the end of the year, a fire destroyed the Dome mill, and this interfered with production at that property. Development work was continued, however, and at the end of the year resumption of production at an early date appeared probable. In Manitoba, Central Manitoba Mines operated steadily throughout the year.

British Columbia's production of gold in 1929 was derived chiefly from the Premier mine. Other principal sources were the Granby, Britannia, Nickel Plate, and Pioneer properties. Production of some alluvial gold was reported, but the output from this source is now, and has been for several years, comparatively small. In the Yukon, most of the output was obtained from alluvial gold deposits.

Expectations are that in 1930 some new properties will be brought into production, particularly in Ontario and Manitoba. The Howey property, in the Red Lake area, will probably be brought into production early in the year. Developments at the San Antonio property are highly regarded, and work there is being continued.

Silver production in Canada in 1929, of 22,368,115 oz., valued at $11,870,000, was a 2 per cent gain in quantity, but a 7 per cent decline in value, compared with 1928 records. Production in Quebec was slightly below the total for the preceding year, but the output from Ontario properties advanced to a total of about 8,200,000 oz., compared with 7,234,414 oz. in 1928. British Columbia produced 10,247,830 oz., in 1929, compared with 10,943,502 oz. in the preceding year; Yukon production of 3,122,619 oz. was greater than that for 1928, which was 2,832,668 oz.

Cobalt, the Canadian output of which represents from 50 to 55 per cent of the world's supply, was produced steadily throughout the year. The 1929 output of fuels and non-metals was valued at $97,321,000, which amount is a gain of 4.4 per cent compared with the value of $93,239,852 recorded in 1928.

Canada's output of asbestos, derived from the mines of the Thetford district that supply more than 85 per cent of the world's output, amounted in 1929 to 305,575 tons, valued at $13,337,000, or 12 per cent more in quantity than in the preceding year and 18.6 per cent more in value. These figures set a new tonnage record, but the value was slightly below the previous record.

Output of feldspar in Canada in 1929 amounted to 35,000 tons, valued at $325,000, representing a gain of 9.7 per cent in quantity and 14 per cent in value when compared with the preceding year. Gypsum production improved slightly, amounting to 1,256,000 tons, compared with 1,246,368 tons in 1928. The value of the gypsum output was $3,666,000, or about 2 per cent less than that for the preceding year. Gypsum quarries are operated in Nova Scotia, New Brunswick, Ontario, Manitoba, and British Columbia. Nova Scotia is the principal producer, and the greater part of the output from this province is exported to the United States.

Developments that led to the establishment of new output records in many minerals, and, in the aggregate, for the Dominion, in 1926, 1927, and 1928, so taxed the production capacity of the existing mines and mills that large programs of expansion were drawn up in 1929. The activity of the mineral industry in Canada throughout the year indicated that continued advances might be expected for some time.

Increased outputs in 1929 resulted, in large measure, from greater efficiency in operation. Increases in the capacities of existing mills, and the building of new smelters and refineries, will provide the necessary additional facilities for the treatment of ores from the mines now being developed or enlarged.

Little change in total output may be expected in the first half of 1930, but the latter half of the year holds much greater promise, particularly in respect to larger outputs of nickel and copper; also, if prices do not decline, production of lead and zinc will increase materially. Gold production is likely to be maintained and probably increased, and so also with silver production. Output of non-metallics also should improve.

Asbestos, gypsum, and feldspar are finding new and profitable markets. Cheap and abundant electric power will promote secondary manufactures based on mineral products. Labor conditions are excellent. The future holds much in store for Canada's mineral industry.

Mining in South Africa and Rhodesia

OWEN LETCHER

DESPITE a falling off in native labor supply, and notwithstanding the fact that the mines of the Main Reef Series are rapidly becoming deeper, and that main lateral haulages are increasing, the Witwatersrand established a new record of gold output in 1929. The total gold production of the Transvaal for the year was valued at £44,259,778, compared with £44,024,058 in 1928.

In so far as technology is concerned, attention continues to be focused on further increasing breaking efficiencies. The employment of pneumatic picks, which are used for dressing down the face after blasting, has materially aided stoping. In the face of continued native labor shortage, more and more consideration is being given to the merits of various types of muckers, slushers, and mechanical lashing appliances.

With increasing depths, problems relating to underground hygiene and health are demanding closer investigation. The government of the Union of South Africa recently appointed a commission to review the subject of phthisis in all its aspects, and amending bills and new legislation may be introduced in an early Parliamentary session.

Although some of the older outcrop mines of the Rand, such as the Wolhuter, Ferreira, Meyer & Charlton, and New Primrose, have either completely suspended operations on account of exhaustion of tonnage or else are on the point of closing down, other undertakings on the Far East Rand are being developed. Production from these latter properties will probably more than compensate for the shutting down of the older mines which have not been operated on a scale commensurate with that planned for the new Far East Rand ventures. At present, three large mines are being developed on the Far East Rand—namely, the East Geduld, Daggafontein, and Witpoort Gold Areas; another potential gold producer—Grootvlei—adjoins East Geduld on the east. This latter property is under the control of the Lewis & Marks group, and the owners are awaiting the results of further development at East Geduld before formulating an exploratory program.

The most encouraging prospects for expansion of operations on the Rand exist in the Far East Rand. An extension of current operations in other areas, however, also appears to be probable, notably at Luipaardsvlei. In addition to expansion at properties which are mining orebodies at comparatively shallow depths, consideration must also be given to the possibility of profitably following the gold-bearing conglomerates down to still greater vertical depths than have so far been reached.

Little definite information is available concerning the production of diamonds, because publication of monthly sales statistics has ceased. However, the assertion can be made that the great waves of alluvial production, in both the Lichtenburg and Namaqualand districts, which threatened to engulf the activities of the older mines have abated.

The platinum boom has long since subsided, and now a period of steady development and equipment has taken the place of the feverish speculation of a year or two ago. In the Lydenburg district, the Onverwacht mine has almost exhausted its tonnage, and early cessation of operations at this property is probable. The Rustenburg district, situated in western Transvaal, commenced platinum production on an extensive scale at the end of July. The pioneer producer is Waterval (Rustenburg) Platinum, Ltd., which is under the technical control of Consolidated Gold Fields. Potgietersrust Platinum Company, which has extensive interests in this district, has also completed a producing plant.

The Union of South Africa has vast base-metal productive possibilities, and, in his presidential address delivered before the Chemical, Metallurgical, and Mining Society, Dr. Pirow, government mining engineer, spoke optimistically about the future of the "other mineral and metal" production of the Union. But if South Africa is to reap the full benefit of the base-metal harvest, producers and exporters will have to pay more heed to maintenance of a definite grade or standard of quality, and will have to deliver larger bulk quantities of that grade more regularly than they have. The minerals are available, without question, but the manner of marketing some of the "newer" ones has occasioned the denunciation that South Africa is a country of samples. Slackness in regard to grading and marketing did almost irreparable harm to the promising corundum industry which the Transvaal was developing a few years ago, and similar laxity should not be allowed to impede the growth of rapidly developing, but still youthful, mineral industries, which include asbestos, manganese, and chrome-iron ore.

In 1929, the principal base-metal or "other mineral" developments that took place in the Union were concerned with what might be termed the "new" minerals of the country—namely, asbestos, chrome-iron ore, and manganese, as opposed to the branches of the mineral industry that have been active for many years past, notably tin and copper.

Since the conclusion of the Great War, the output of asbestos has been increasing. Production, which in 1918 was valued at £54,000, increased to £216,466 in 1926, and in 1928 to nearly £400,000. For the early months of 1929 output averaged about £37,000 per month, so another record year's production may apparently be expected. In many parts of the Union, and of adjacent territories as well, prospecting and development of asbestos deposits have been intensified, and large areas containing both blue and white asbestos have been opened up. Prospecting has, in particular, been intensified in the Pietersburg, Carolina, Barberton, and Kuruman districts, and also in Swaziland and South West Africa.

Chrome-iron ore production has also increased in recent years. Prior to 1923, the value of the Union's chrome-iron ore output amounted to £500, but in 1926 it was £14,623, and in 1928 £35,265. In May, 1929, the value of the month's production was £15,576.

The manganese deposits of the Postmasburg district have provided one of the sensations of the year, in so far as base-mineral development is concerned. After protracted and lengthy negotiations the Manganese Corporation of South Africa was formed and railway connections with the manganese fields were provided for. The ore will be smelted at Colenso and will be exported from Durban. Base-metal producers of the Union intend to work in conjunction with the governmental iron and steel plan to produce in South Africa various kinds of ferro-alloys, such as ferro-chrome, ferromanganese, and ferro-vanadium.

So far as copper is concerned, the most impressive developments have, of course, taken place in Northern Rhodesia, but in the Union, as well, the rise in the price of metal and the great interest in African deposits have stimulated copper production. Output, which totaled 9,900 tons in 1928, was more than maintained in 1929. The Messina Company, in northern Transvaal, and the Namaqualand Copper Company, at Concordia, Namaqualand, have, as in previous years, been the principal producers. American interests, after three years of prospecting, have decided to reopen the Cape Copper Mines, in Namaqualand.

The outlook for gold mining in Southern Rhodesia is not altogether satisfactory. Prospects at both the Shamva and the Rezende are rather depressing. On the other hand, the Mayfair has commenced crushing, and the Wanderer's new plant is coming into commission. An attempt to reopen the Giant property, at Gadzema, is being made, and encouraging features may be observed at one or two of the larger of the so-called "small-man" properties, such as the Golden Valley and the Antelope. On the whole, however, indications are that gold mining in the colony will probably contract further rather than expand.

The outstanding feature of 1929 in South African mining was the continuation of highly satisfactory developments at the various mines being opened up along the Northern Rhodesian copper belt. Until a year ago, much skepticism as to the magnitude and payability of the field was evident.

On two or three previous occasions, the Bwana M'Kubwa mine, which may rightly be described as the pioneer copper property of the country, had given disappointing performances, and in South Africa a general feeling prevailed that the prospects of this and other undertakings had been boomed to an extent which was unjustified by actual prospects and performance. The turn of the tide may be said to have begun eighteen months ago, when the continuation of remarkably satisfactory developments on the Roan Antelope syncline indicated clearly that that the Roan property was to become a great copper mine. A plant of 6,000 tons' daily capacity, with provisions for duplication, is being erected at the Roan Antelope property. Simultaneously, the N'Kana mine, of the Bwana M'Kubwa company, is being developed in a similarly satisfactory manner. A pilot plant is being placed in operation at this property, and equipment of the same capacity as that being installed at the Roan will probably be erected. Large smelting plants will be constructed at both mines.

Ore exposures at Mufulira, N'Changa, Chambesi, and other properties are also remarkably good. Drilling and development work on these Northern Rhodesian properties in 1929 definitely established the fact that Northern Rhodesia is one of the greatest copper belts in the world, and indications are that its productive capacity is, at least, 350,000 tons of copper per year. Such an output will probably be attained in six or seven years.

In the Katanga province, of the Congo Belge, further steady growth of copper production, as the new leaching plant at Panda comes into full operation, may be expected in 1930.

To sum up the outlook for 1930: The probabilities are that the Rand in 1930 will maintain its rate of output, and, if any relief in respect to native labor supply is achieved, the managements will probably be able to further increase production and improve working costs. Steady expansion of the asbestos, chrome-iron ore, and manganese industries of the Union is indicated. Continuation of the development and equipment of the Northern Rhodesian copper mines will probably again be the most spectacular and important event in British South African mining in 1930. A feature of the year's operations in the North is likely to be the intensification of research into the treatment of oxide-sulphide ores. The new segregation process, evolved by Minerals Separation, Ltd., will probably play a highly important part in the metallurgical treatment of the ores of the field. The Empire Mining and Metallurgical Congress, to be held in South Africa in the spring, should focus world-wide attention on the mineral resources of the subcontinent.

The Mining Industry of Mexico

S. D. STRAUSS
Assistant Editor

THE TEMPERAMENT of a people is not infrequently reflected in the news dispatches that come from out their midst. Those interested in the Mexican mining industry should remember that truism before jumping to conclusions when reading extravagant dispatches about the industry's condition. Although at least four factors appeared during the year to menace the development of the industry, mining in Mexico during 1929 was far from crippled. In spite of the revolution in the spring, the threatened labor legislation in the early fall, the serious power shortage in Chihuahua, and the declining price of silver throughout the year, the value of Mexican metal production in 1929 will probably compare favorably with the record for 1928. By combining the latest statistics from official government sources with the figures of the American Bureau of Metal Statistics, one may deduce the following:

Copper production will show an increase of at least 15,000 tons over the figures for 1928. Figures of the A.B.M.S. show 43,888 tons of blister produced by Mexican smelters in the eleven months ended November, 1928, and 58,451 tons for the same period in 1929. This does not include ore and concentrate smelted outside of Mexico. Lead production for the same period and from the same source is given as 235,286 tons in 1928 and 252,794 tons in 1929. Silver production will show a decrease of about 7,000,000 oz., from 108,536,000 to 101,000,000 oz. The decline in the price will make the value considerably less. Because most Mexican zinc ore is treated in foreign smelters, production figures are extremely elusive. Total production should be about 145,000 tons, compared with about 160,000 tons in 1928. Gold production will be about 660,000 oz., compared with 699,000 oz. in 1928.

The revolution in March and April did not interfere seriously with operations of the larger companies, but shipments from outlying mines were delayed. Within a month after the disturbances had ended, the industry had completely returned to normal. Much more concern was caused by the proposed labor law, which was under discussion by the Mexican national legislature throughout its fall session. The law consisted of an extremely elaborate code regulating hours of labor, wages, housing conditions, methods of settling disputes, and other matters that had previously been dealt with only by the state governments. Protracted discussion in Congress failed to dispose of more than one-tenth of the articles in the code. The new administration is said not to favor it in its present form.

Work on construction of a new steam power plant at Torreon, Coahuila, is now almost complete. This plant will supply power to the Chihuahua mines affected by the shortage from the Boquilla plant, caused by lack of rain. Most Chihuahua mines had to cut output toward the end of the year.

The decline in the price of silver from 57.5c. to 46.7c. an ounce during the year did not affect production of Mexico's chief metal product as markedly as might have been expected. In fact, the greater part of the loss in output may be attributed to exhaustion of the mines in the El Oro district. Prospects for silver mines in 1930 are not favorable, however, and talk of curtailment is widespread.

At Pachuca, Real del Monte, subsidiary of U. S. Smelting, continued production on about the same scale as in former years, but made preparations for important changes in treatment methods. A centralized program of construction is now being completed that will result in treating the entire tonnage of 3,000 tons daily in its Loreto mill, instead of in two mills as formerly. Transportation by cable tramway will be superseded by a main haulage level connecting the two principal groups of mines. Santa Gertrudis, the second largest producer in the camp, maintained its output. Development work now centers on the Dos Carlos mine, as several of the other properties are nearing exhaustion.

At El Oro, Mexico's famous bonanza silver-gold camp, Dos Estrellas, the only large producer still in operation, has made application for permission to close. Production in 1929 was 770,000 tons of ore, averaging 0.1 oz. of gold and about 3.8 oz. of silver to the ton. Mexican Corporation, at Fresnillo, Zacatecas, had a profitable year in spite of low silver prices, and was able to pay its first dividend. Production was slightly higher than in 1928. Importance of the sulphide unit is increasing, as development has shown additional reserves.

At Parral, Chihuahua, American Smelting & Refining has closed down its Veta Grande unit, which produces silver ore, until the power situation in that state has been restored to normal. Construction of a 300-ton unit for treating carbonate silver-lead ore from the Santa Eulalia mines was started in the spring. The plant will be completed about March of this year. A program of expansion is being undertaken at the company's San Luis Potosi properties, including sinking a new shaft at San Pedro and a 500-ton mill to be built in the city of San Luis Potosi. Operation of the new $1,000,000 lead refinery at Monterey, Nuevo Leon, was started in April.

Peñoles Mining, American Metal's Mexican subsidiary, added a baghouse and a Dwight & Lloyd sintering plant to its lead smelter at Torreon, Coahuila in 1929. At the Achotla silver-gold mine, in Guerrero, the 300-ton cyanidation plant was changed to the all-brine leaching method. Production for the year of all units was slightly higher than in 1928.

Deepening of three of the main shafts at Howe Sound's Potosi unit, near Chihuahua City, was started, following the installation of a new hoist at the Santo Domingo shaft. Mill capacity has been increased to about 1,500 tons of lead-zinc ore daily, of which only 800 to 900 tons is being used, because of power shortage. The company's Calera unit has been closed permanently. Some exploration work is being undertaken in Zacatecas. San Francisco Mines of Mexico, at San Francisco del Oro, was also affected by the power shortage, and production will be lower than in 1928. This company is considering construction of a new zinc plant near the Texas boundary, but no announcement as to treatment method has yet been made.

In the Los Lamentos district, production from Ahumada Lead increased slightly. Installation of additional pumping equipment will permit regular production from No. 8 level. Erupcion Mining produced only small quantities of ore during the year, but continued development work. At the Gloria group in this district California-Ahumada developed a small new producer, from which regular shipments will be made to the El Paso smelter. Figures of production of copper and lead are not available from Mazapil Copper, operating properties near Concepcion del Oro, Zacatecas, but the company is understood to have increased output.

At the Greene Cananea property, in Sonora, now the largest copper producer in the country, the famous Colorada mine has been brought into full production, and remodeling of the flotation plant is under way. Development has also been started in Cananea-Duluth ground, after unwatering of the shaft. Output has been curtailed for several months, in accordance with the reductions made in other copper mines, but the total for the year will be considerably higher than in 1928. Moctezuma, Phelps Dodge's Mexican mine, produced slightly more copper in 1929 than in 1928.

Boleo Copper, the French company operating in Lower California, was disturbed by labor dissensions. Production was nevertheless maintained at the usual rate of slightly more than 1,000 tons of copper a month throughout the year. The Teziutlan unit of Mexican Corporation increased its output slightly. Development has shown a new orebody at this property.

South American Mining in 1929

S. D. STRAUSS
Assistant Editor

METAL MINING was a quiet industry in South America throughout 1929. The important changes that took place in the prices of its principal products seem scarcely to have affected the scale of operations, not a surprising state of affairs, as the entire production is virtually controlled by a few large operators. Copper production increased 10 per cent, or about at the same rate as the world increase. Bolivian tin, despite lower prices, was also produced in slightly larger quantities.

Chile's metal-mining industry is confined to copper and iron, with gold and silver as byproducts. The large American-controlled copper mines are now on a curtailed basis, but the smaller properties are making plans for increasing output, to take advantage of the tempting 18c. price. Total production of copper was about 700,000,000 lb., compared with 638,000,000 lb. in 1928.

At Chuquicamata, Chile Exploration, the largest producer on the continent, made slight changes in its plant and equipment during 1929. Two electric locomotives were added, bringing the number of these units in operation up to fourteen, with six more on order. An additional electric revolving shovel was also put in operation at the mine. During the first nine months, copper production amounted to 243,877,496 lb., resulting from treatment of 8,556,804 tons of ore, averaging 1.637 per cent copper. Final results are not yet available, but the year's total will undoubtedly be the largest in the company's history. Construction of an addition to the oxide-ore treatment plant at Potrerillos was started by Andes Copper in 1929. It will treat slimes removed from oxide ore prior to delivery to the leaching vats. The slimes will be subjected to agitation leaching and the copper in the enriched solution will be recovered by cementation. To provide the acid requirements of this plant, extension of the sulphuric-acid plant was started. Concentrator capacity has been raised by increasing the Marcy ball mills 2 ft. in length. In the flotation department, a new class of concentrate, with a high iron-sulphur content, was produced to provide the sulphur required in the sulphuric-acid plant. Copper output was much higher than in 1928, reflecting the first complete year of continuous operation of both oxide and sulphide plants. About 130,000,000 lb. of copper was produced in the first nine months. Production from Braden Copper, at Rancagua, was affected by lack of tailing disposal space, resulting from the destruction of the tailing dam in an earthquake, and the total was lower than in 1928.

Of the small Chilean producers, Disputada, now producing at the rate of 5,000 tons of copper a year, is enlarging its flotation plant to handle 500 tons of ore daily, and is constructing a new 350-hp. hydro-electric plant to supply additional power. Poderosa Mining, an English company, reports production of about 14,000 metric tons of 18½ per cent ore in 1929. M'Zaita, the French company which took over the Chagres properties, produced about the same amount of copper from the smelter as in the preceding year, but 1930 is expected to show a substantial increase, as the new 500-ton concentrator at the Soldado mine will start operation. Smelter capacity is being enlarged. American Smelting & Refining dropped its option on the Tamaya mine, near Ovalle, in December, after developing it for the last two years.

In Peru, the copper, silver, and gold output of Cerro de Pasco Copper was about equivalent, on a combined basis, to its 1928 production. Lead and zinc production showed an increase in tonnage but a drop in value. Notwithstanding extraction of the largest tonnage of copper-smelting ores in their history, it is understood the mines will show larger reserves than at the end of last year. Cost per ton of ore mined is said to be the lowest yet obtained. The 12,000-ft. Bellavista tunnel, at Casapalca, started in 1926, was connected with the main mine workings on the 2,100 level during the year just past. A new lead-zinc concentrator, designed to replace the old one at Casapalca, will be located near the portal of this tunnel and should be in production in 1931.

The development and drainage tunnel from Mahr, on the Yauli River, to Morococha was driven about 2,000 ft. from the portal. Heavy, wet, running ground was encountered late in 1929, necessitating heavy timbering. This difficulty has now been overcome. At the recently acquired Yauricocha copper mines, about 50 miles south of Oroya, hand work only in the mine has disclosed from 400,000 to 600,000 tons of positive and probable ore of 9 to 10 per cent copper. Surveys and estimates on a transportation line, to serve both the Yauricocha mines and the Jatunhausi coal fields when they are brought to a producing stage, are now being studied.

Plans for a permanent plant to treat the low-grade oxidized silver-lead ores, locally known as Cerro *pacos*, have recently been completed. The ore deposit is being resampled and the estimated costs and recoveries are being checked by disinterested experts. Decision as to proceding with construction will depend in part upon trend of the metal markets. At Oroya, the addition to the converter Cottrell in the copper smelter was completed and is operating successfully. A second lead furnace is expected to begin production at Oroya soon. Lead output for 1930 will probably show a substantial increase. Experimental work with a small reverberatory furnace for reduction of stock on hand and the current production of flue dust to lead-bismuth-silver bullion was continued. The research laboratory at Oroya was completed, and work started on several problems of importance. Early in 1930 the new 25-ton test concentrator should start experiments on Cerro de Pasco lead-zinc ores, as well as on low-grade copper and other ores.

Power developed by the corporation at the two hydro-electric plants on the Yauli River and at the Oroya steam plant averaged about 23,660 hp. for 1929, compared to 21,150 hp. for 1928. Under the direction of Sanderson & Porter, consulting engineers, work on the new hydro-electric plant, to be erected about 16 miles north of Oroya at Malpaso, on the Mantaro River, has been started. This plant should be operating some time in 1931.

Northern Peru Mining & Smelting has installed a Cottrell plant at its Shorey copper smelter. In addition, a Dwight-Lloyd sintering machine is now under construction that will handle concentrate from the Shorey mill, as well as fine oxide ores and flue dust from the Cottrell plant. At its Pataz mine, the company increased mill capacity about 35 per cent. Additional hydro-electric power to supply the increased demands was developed. The company purchased the Chilete mine, a lead-zinc property near Pacasmayo. No plans have yet been made for placing the property in production.

In Bolivia, tin production showed an increase of about 2,500 tons to 44,000 metric tons. Despite lower prices, Patiño Mines & Enterprises again increased its production. More complete data will be published in a forthcoming issue. Of the other large producers, Aramayo and Caracoles made no changes of consequence in their scale of operation.

South American Gold & Platinum continued to operate three dredges in the Condoto River Valley, Colombia. The second unit of the hydro-electric power plant on the Andagueda River was completed and put in operation. Production for 1929 is estimated at 23,500 oz. of platinum and 8,000 oz. of gold, compared with 26,393 oz. of platinum and 8,555 oz. of gold in 1928. In Brazil, St. John del Rey produced gold worth about £500,000, as compared with £415,000 in 1928.

Europe, Siberia, Far East, and India

W. A. DOMAN

LEAD mining in Derbyshire, England, is more active, particularly at the Mill Close mine, which had been operating on a limited scale. At a depth of 650 ft., a new deposit of lead has been found, and night and day shifts are being worked.

The low price of tin in 1929 created a policy of caution in Cornwall, and producers that can work at a profit keep output at a reasonable level. At the Duchy property, which is highly mineralized, prospecting is being vigorously pursued. Much unemployment continues in the district.

The Rio Tinto Company greatly enlarged its sphere of activity in 1929. Profits earned in the twelve months ended June 30 totaled £1,403,800, after deducting arrears of taxation, and dividends amounting to 40 per cent were paid. The company recently announced that although the average copper content of the massive pyrites being mined was declining slowly, the copper content of the porphyritic ores was holding up well.

Distribution of ores from Norway, Portugal, and other countries was proceeding satisfactorily in 1929, and the Welsh plant at Port Talbot was running well. Operations by the Pyrites Company were said to be proceeding in an encouraging manner. The European Pyrites Corporation, owned jointly with the Metallgesellschaft, continued the work of European ore distribution satisfactorily. Good progress was also being made with Silica Gel in conjunction with the Davison Chemical Company. The capital of Silica Gel has been raised to £6,000,000, and the company, in addition to operations in Spain, is participating in the exploitation of copper deposits in Northern Rhodesia. This action was taken after its engineers had reported on the prospects there.

The Peña Copper Company, though working on a small scale, made some progress in 1928. Its accounts, presented in September, showed that from the treatment of 101,136 tons of ore, 765 tons of fine copper was produced, as compared with 708 tons of metal from 112,632 tons of ore in 1927. Profit in 1928, reported for the San Domingos mine, in Portugal, owned by the Mason & Barry interests, amounted to £45,000, excluding depreciation; this was an increase of £7,000 over the preceding year. The profit would have been higher but for falls of ground in the open-cast. The new power unit and milling plant are working well. Output for 1929 is expected to show a substantial increase. The bulk of the mine's revenue is derived from the sale of sulphur and iron recovered from the ore.

The Huelva Copper Company paid a dividend of 75 fr. per share and a bonus payment of the same amount. The scale of operations was increased in 1929 to 290,000 tons annually, as compared with 255,000 the preceding year. Recent mineral discoveries assure a potential ore supply of about 300,000 tons annually for a long time to come. With this rate of operation in view, and in order to pay for the mines at Dielette and a manganese deposit in South Africa, the authorized capital of the company was increased from £422,100 to £1,005,000. The Tharsis Sulphur & Copper Company reports an improvement in the demand for pyrites and the discovery of a new lode containing massive pyrites of good quality.

In Serbia, activity has continued at the Mines de Bor, which has installed flotation equipment to treat low-grade ores. An extensive exploitation program is intended, as a large reserve of ore is available that assays 2½ to 3 per cent. With copper at 18c. per pound, a profit can be made on this ore. The area of the property either actually owned or held under *permis de recherches* is 19,472 hectares. Production for the first nine months was 14,820 tons, compared with 10,655 tons in the corresponding period of 1928. San Platon Copper Mines, owing to a satisfactory contract made with Rio Tinto, earned a working profit of 2,700,000 fr. for the first seven months of the year, compared with 2,673,275 fr. for the entire year of 1928. One or two discoveries of copper were made in 1929, an English company having acquired a copper deposit in East Finland that assays 4 per cent. Another deposit was found near Stephan, in eastern Poland.

With regard to lead operations on the Continent, Mines de Villemagne, treated nearly 100,000 tons of ore in the first nine months of 1929 and produced 7,741 tons of zinc concentrates and 2,771 tons of lead concentrates. This output is a substantial increase above that of the corresponding period of the preceding year. Prospecting shafts at the Diogene mine of the Penarroya Company are reported to have encountered a deposit of galena with a high silver content. Owing to lack of possibilities in Spain, the company has acquired interests in Serbia and North Africa. The company has formed a Yugoslavian subsidiary, at Belgrade, with a capital of 10,000,000 dinars, to prospect for lead and zinc.

A concession has been granted by Yugoslavia to the American Smelting & Refining Company for the prospecting of the Srebrenica district and the exploitation of the Srebrenica mine, in Bosnia. The concession extends over 60 years, actual exploitation to begin within five years. The mine is said to be rich in lead and was operated both in Roman and medieval times. British capital is being invested in Yugoslavia, Selection Trust, Ltd., having promoted the Trepca, Novo Brdo, Janjevo, and Zletovo properties, all of which contain lead, zinc, and silver deposits.

The Tigon Mining & Finance Company reports that the development of its sulphur deposits is proceeding satisfactorily. Until the new plant for sulphur extraction is completed, the old Clarete furnaces are being employed. As prospecting on the tin area has not proved satisfactory, this part of the property is being neglected for the time, but drilling is proceeding in the antimony-silver-lead area. Société Minière Industrielle de Tamega has obtained a concession from the Portuguese government that embraces thirteen tin mines. The French Silleda Company is acquiring new deposits in the vicinity, and hopes by the middle of 1930 to be treating 100 tons of tin ore daily. The Beralt Tin & Wolfram Company, in Portugal, has entered into some favorable forward contracts that continue to March, 1931. Wolfram is at present being mined in preference to tin, in consequence of the low price of the latter metal.

Asbestos mining is on a slightly larger scale. The Cyprus Asbestos Company has now a mining capacity, for an entire season, of 550,000 tons, and is planning to reach an output of 40,000 tons monthly. Southern Asbestos Mines, Ltd., has been formed, with a capital of £200,000, to deal in mineral rights and to acquire the asbestos mines at Lanzada, in Lombardy, close to the northern frontier of Italy.

The mineral resources of Roumania, principally the chromium deposits in the south of the Banat, in close proximity to the Danube, are attracting attention. Deposits of bauxite, bismuth, molybdenum, and gold are also being investigated. Attention is likewise being directed to some magnesite mines in the Tchatchak region.

Mining in Russia has not greatly interested capital outside of the Soviet Republic, owing to conditions of working and to the insecurity both of the money put into the mines and the metals extracted therefrom. The great copper mines remain closed down, as a result of this doubt concerning the good faith of the authorities. A German syndicate is, however, negotiating for the reopening of the Spassky copper mines. A premium is paid for gold produced, but propositions are not attractive. The Russo-Asiatic Company can obtain no satisfaction in connection with its concessions. A commission is sitting in

Berlin to reorganize the Russian aluminum industry. The Soviet government will, it is said, advance £3,000,000, of which £200,000 will be used for the purchase of German machinery. Manganese mines continue to be worked by the government, and sales are made at prices with which other companies cannot compete. A Russian geological expedition is visiting Pamir, in Central Asia, to explore the upper reaches of the Muk-Su River for gold. In Siberia, Lena Goldfields continues its operations, though the financial position is by no means clear, for the price of the £100 "notes" issued for working capital has declined to £33. The capital is being increased, and American firms are participating, the object being to augment the plant. The Tetiuhe Mining Corporation has developed a large tonnage of silver-lead-zinc ore, and is operating at the rate of 100,000 tons per year. The last accounts showed a debit balance. To August, 1929, 9,553 tons of zinc concentrate was produced, and 4,580 tons of lead concentrate, the average of the former being about 45 per cent zinc and the latter 75 per cent lead.

Operations by the Burma Corporation continued satisfactorily throughout 1929. For the last financial year of the company, refined lead produced was 78,716 tons, compared with 72,388 tons for the preceding year, and refined silver 7,376,841 oz., compared with 6,954,665 oz. High values have continued in the development of the Shan and Chinaman orebodies. Ore reserves are estimated as 4,140,969 tons, assaying 21.2 oz. silver, 25.9 per cent lead, and 15.8 per cent zinc.

The Great Nurupi mine, of the Chosen Corporation, treated, in its last financial year, 93,751 tons of gold ore for a total yield of £125,108. Working profit was £32,838. On June 30, 1929, ore reserves amounted to 198,851 tons, of an average grade of 7.16 dwt. The electrical power installation has provided the mine with an adequate supply of continuous power; and the new leaching plant is now in operation. A geological survey is being made of the East Nurupi mine, and mining operations will probably be resumed at the property in the near future.

Indian mines pursued a normal course in 1929, little beyond a few "rock bursts" occurring to interfere with operations. The four principal companies—namely, Mysore, Nundydroog, Ooregum, and Champion Reef—milled a total of 509,816 tons, for a yield of 274,342 oz. of fine gold to the end of August. Quite a surprise was sprung on the market in the early days of November by the announcement that the Mysore Company had cut a reef in the Pilot shaft at a dept of 280 ft., averaging, where exposed, 21 in. in width and assaying 3 oz. 8 dwt. of gold per ton. This shaft is 1,600 ft. east of the main workings of the mine. The bottom levels of Ooregum showed a sudden decline in value during the middle of the year, and have not yet improved.

Apart from copper, the greatest excitement in the metal world has been in tin. Reviewing the position, it has been not only a case of supply and demand, but of speculation. Combinations to restrict output, or to raise the price of the metal, have come into being. There are apparently three great parties: the British, in Malaysia; the Dutch; and the French. The Banka and Billiton companies are against restriction in any form. The Malayan companies have so many dredges in operation, and to come into operation, that production is likely to increase. Dredge construction is proceeding at the Rewang Tinfields, Kampong Lanjut, and Kramat Tin, and Malim Nawar is converting its dredge to a 14-in. electric gravel-pump unit that will obtain electric power from the Perak River Hydro Electric Power Company.

Few Nigerian companies can produce at a profit. The Eastern companies that can earn good profits at, say, £180 per ton let those that cannot go to the wall. In fact, the chief secretary to the Malayan government has declared that no scheme for the restriction of tin production would be likely to attract his favorable attention; a restriction on leases will be exercised in the future. Output of tin and tin in ore from the Federated Malay States for the ten months ended Oct. 31, 1929, was 55,059 tons, an increase of 4,000 tons compared with the corresponding period of 1928. The Pahang Corporation, which is conducting a lode-mining operation, continues to do well.

The Tin Producers' Association is considering a scheme by which smelters should withhold from treatment a portion of tin ore handed to them. This, it is thought, will enable the price of the metal to be raised. As restriction of output has not yet been considered, the position is not improved. The fact that some investigation is being made is, however, appreciated.

Mining in Australasia Improves

PETER G. TAIT

SEVERAL encouraging developments were noticeable in western Australian gold mining in 1929. At the last annual meeting of the chamber of mines of that state, the president expressed the opinion that the decline of recent years would be arrested in 1929, and that an increase in gold output might be expected in 1930. Doubtless he had in mind the prospect of increased activity at Kalgoorlie, as a result of the amalgamation of the Lake View and Golden Horshoe mines, and the decision of the new Great Boulder Perseverance Company to erect a modern treatment plant. Development of the extensive deposits at Wiluna augur well for the establishment of a new permanent gold-producing district. The government is so well satisfied with that venture that it has begun construction of a railway line from Meekatharra to the field. A treatment plant, including a flotation concentration section, with a capacity of 40,000 tons of ore per month, is being constructed. At first, fine crushing in a reducing atmosphere was planned, to prevent oxidation of the pyrite before it passed to the flotation section. Recent experiments have demonstrated, however, that, by conditioning the flotation circuit, grinding in a reducing atmosphere is not necessary. Furthermore, if the flotation product is freed from all gangue, no appreciable volatilization of the gold occurs.

The only other gold field of current importance is situated in New Guinea. In the mandated territory of that large island, which lies north of Queensland, the Edie Creek field is attracting considerable attention. The main development is now controlled by the Edie Development Company, formerly known as Ellyou Goldfields Corporation. This company will ultimately become New Guinea Goldfields, Ltd., and will have a nominal capital of £5,250,000. Mining Trust, Ltd., of London, guarantees a subscription of £750,000 working capital. Regular production has been proceeding, and, since the opening up of the field in October, 1926, to December, 1928, 263,654 oz. of gold, valued at approximately £580,000, has been exported. In the year 1929, about 100,000 oz. additional was recovered. The areas held by Edie Development were responsible for the bulk of the output. Exploitation of the reef system is in progress, and high hopes are entertained by the promoters. Prospecting is also now active in other parts of the Territory of New Guinea and in Papua. During the last two or three months numerous companies have been registered, and the adjacent small island of Misima, where a treatment plant was erected a few years ago by a subsidiary of the Broken Hill Block 10 Company, is also being prospected again.

The prosperity of the main Broken Hill mines continues. The only development of importance is the decision of the "big three"—North Broken Hill,

Broken Hill South, and Zinc Corporation—to erect a central power station operated by crude-oil engines. This work is under way at an estimated expenditure of £500,000. In addition to the aforesaid three mines, the Sulphide Corporation at its Central mine, Broken Hill Proprietary, and Block 14 are raising ore. Little is being done at other mines in the district, the low price of metals militating against development.

The Broken Hill Associated Smelters, at Port Pirie, which is controlled by the "big three" group, recently acquired a large interest in Electrolytic Refining & Smelting Company, of Port Kembla, which formerly refined the output of the Mount Morgan and Mount Lyell mines. Mount Lyell, however, now has its own copper refinery.

The Lake George Mining Corporation, Ltd., was recently registered with a nominal capital of £1,000,000 to take over the properties held under option by Camp Bird, Ltd., at Captain's Flat, New South Wales. Systematic development work has been under way for several years, and proved reserves comprise 1,561,761 tons, averaging 7.50 per cent lead, 12.94 per cent zinc, 0.77 per cent copper, 2.31 oz. silver, and 1.29 dwt. of gold per ton. The New South Wales government favors the construction of a branch railway, but is postponing action until erection of a milling plant is begun.

Developments at the Mount Isa silver-lead-zinc mines are being watched with considerable interest. Ore reserves in the various mines of the group are said to aggregate 25,000,000 tons of commercial grade ore. The Queensland government has constructed a railway to the field, and the company is busily engaged on the development of the mines, the erection of milling plant, and the establishment of the numerous facilities necessary in a hitherto unoccupied district.

Mining Trust, Ltd., has received from the Queensland government prospecting rights over an area of 100,000 acres at Lawn Hills, 185 miles from Cloncurry and 115 miles northeast from the railway at Dobbyn. By the terms of the agreement Mining Trust will spend not less than £100,000 in five years on prospecting the area. The silver-lead deposits have been known for many years, but their unfavorable situation has prevented their commercial exploitation. If extensive prospecting and development bear out the anticipation of the geologists, construction of a railway will probably be undertaken.

Electrolytic Zinc Company, which has been producing approximately 50,000 tons of zinc at its Risdon works, in Tasmania, is increasing the plant capacity to 70,000 tons annually. The company is also developing the Read-Rosebery mines. A modern milling plant is being erected at Rosebery, and the company is building houses and quarters for the large staff that will be employed there.

The Mount Morgan gold-copper property in Queensland has been acquired by a new company and is planning to resume operations on a smaller scale. A. A. Boyd, general manager of the former operating company, was a member of the purchasing syndicate and will take an active part in the management. The labor situation at the property has improved, and, with a favorable copper market, the new company may operate the property successfully for some years.

Copper mining on the Cloncurry field is largely in the hands of tributors, who are gouging out the richer ores from the old mines. Resumption of mining and smelting operations is being considered at Mount Elliott, but no definite information is available. The company controls extensive freehold and leasehold areas near Cloncurry, and also at Mount Oxide, 160 miles to the northwest. Reserves at Mount Oxide are estimated as 41,500 tons of oxide ore, assaying 17 per cent copper, and 250,000 tons of sulphide ore, averaging 9.2 per cent copper. Pending a decision as to local treatment, ore is being shipped to Europe and also to Electrolytic company's plant at Port Kembla. Mount Lyell Mining & Railway Company, Ltd., at Queenstown, Tasmania, is the principal copper-mining enterprise in Australia. The company possesses a complete installation for the mining and treatment of the ore and the production of marketable copper. Normal annual production is between 7,000 and 8,000 tons.

The Briseis tin mine, in northeast Tasmania, intends to resume operations if it can raise £75,000, which is the estimated cost of rebuilding a dam and replacing equipment destroyed by flood waters in 1928. The orebody is an alluvial deposit which is overlain by a heavy basalt and is 120 ft. below the surface and adjacent to the river. A large open cut comprises the workings, and presumably this will be unwatered.

Manganiferous iron ore is being exported to America from the Iron Knob deposits of the Broken Hill Proprietary Company, in South Australia. Another large deposit of manganese ore has been opened up by the West Australian Manganese Company, at Horseshoe Range, Peak Hill, Western Australia.

In New Zealand, the principal gold producer is the Waihi Company, which also mines and treats the ore from the adjoining property of the Grand Junction Company. The Waihi property, however, is approaching exhaustion, and the company, having failed in its search for another property in the Dominion, has acquired a tin-dredging area at Puket, Siam. The Blackwater mine, in the Reefton district, is the only other important gold producer.

The improvement in the price of tungsten has resulted in the reopening of the mines at Macraes Flat, New Zealand, and of others, elsewhere. Several cinnabar deposits are being worked at Ngawha Springs, north of Auckland, by Kaikohe Development, Ltd., a subsidiary of Imperial Chemical Industries, Ltd. Two rotary furnaces have been installed.

Central America

CHARLES BUTTERS

MINING in the five Central American republics in 1929 presented few outstanding events. Possibilities for the production of lead and zinc exist in Guatemala, especially now by selective flotation; neither, however, is produced at present. One Atlantic Coast placer mine continues successful.

The Honduras & Rosario mine, at San Juancito, has a record of 40 years of dividends and is still the most important producer in Central America. The mine, so ably managed by A. R. Gordon, is certainly a model of efficiency to be studied by any company trying to operate at a long distance from a financial center. San Juancito mine activities are carried on in an almost impossible location, in a tropical, revolutionary state, in a wonderful way.

Nicaragua is the richest state potentially in agriculture and gold of all of the Central American states, but is inhabited by a people most difficult to govern. Political hatred smolders among the population, which is one almost impossible to understand. Gold occurs in many districts on the Atlantic seaboard and in the central district and in North Segovia. Gold has always been exported by the merchants, but at present the mining industry is non-existent. The 5,000 Marines and the 300 members of the U. S. Army canal surveying group have provided Nicaragua with an unexpected income that has helped to stabilize exchange, besides quieting the political difficulties and making peace a possibility.

In the future, San Sebastian, on the Pacific watershed, may once more be active in Salvador, and in Nicaragua, San Albini, on the Atlantic watershed. The Chontales property, in Nicaragua, where $2,000,000 was invested, proved to be unprofitable. The long shoot of good ore there did not continue at depth, and the property was abandoned.

In Nicaragua, the Grecia, the only silver mine, owned by Butters Salvador Mines, was the most successful mine during the last twenty years. This property is now exhausted.

Cuba

L. C. PORTER

FOR many years the principal mining activities of Cuba have been confined to the two extremes of the island —that is to say, to the provinces of Oriente and Pinar del Rio. All the provinces of Cuba have evidences of interesting mineralization, but the outstanding mines are the Matahambre copper mine, of Pinar del Rio, and the hematite deposit of Daiquirí, Oriente, which is operated by the Bethlehem Steel Company.

The Matahambre mine, of Pinar del Rio, began shipments in 1912 and has been a steady shipper since that date. A general résumé of the Matahambre activities in 1929 follows:

	Tons Mined
January to end of November	320,287
December, estimated	30,000
Total	350,287

	Pounds of Copper Produced
January to end of November	29,971,658
December, estimated	3,000,000
Total	32,971,658

In April, 1929, a contract was made with the E. J. Longyear Development Company, of Minneapolis, to sink a four-compartment shaft to a depth of 2,200 ft. This shaft is to be used in working levels below the 2,000 level; and is to be deepened as occasion demands. It will be a vertical, steel-lined shaft, equipped with a steel headframe 125 ft. in height. The hoist used for sinking purposes is a 200-hp., double-drum type, manufactured by the Lidgerwood company. Estimates indicate that the shaft will reach the 2,200 level about September, 1930. A main haulage crosscut will then be driven 500 ft. to the ore zone, and raises will be put through to connect the crosscut with the levels above that have been driven from the present main working shaft. The entire output of the mine will be hoisted from this new shaft. Increases in monthly output are expected. Adequate permanent hoisting and pumping equipment will be installed during 1930. The new shaft will be able to handle an increased output, the old shaft serving as a manway, as well as a ventilation shaft.

Ore reserves are estimated at about 1,000,000 tons, and the average payroll shows about 1,000 men employed at the mine and the shipping point, Santa Lucia, on the north coast. The ore, as mined, averages about 5 per cent copper and is a mixture of calcopyrite and pyrites, with shale as the country rock. The ore is concentrated to about 30 per cent grade at the mine, hauled by an aërial tramway to the coast, 8½ miles distant, and is shipped thence to the United States Metals Refining Company, at Carteret, N. J.

In 1928, Matahambre leased, with option to purchase, the Mono deposit that lies about 1½ miles north of Matahambre. The Moto deposit is now being explored by a force of about 25 men. The power plant for Matahambre, which is situated at Santa Lucia, was improved and enlarged during 1929 by the installation of two new 650-hp. Walsh & Weidner boilers and one 1,500-kw. General Electric turbine, bringing the total capacity of the plant up to 4,000 kw.

Matahambre has acted as a stimulus to the development of a large number of copper outcrops in Cuba. In many instances, however, these attempts are so poorly financed and directed that failure results. A few properties, nevertheless, have shown promise, and these may soon become shippers. The most promising of these is the Mina Buena property.

At the Mina Buena mine, in Camaguey Province, work has gone along as well as the limited funds available allowed. Two vertical shafts are being sunk in the mineralized area. These will be connected at a depth of 100 ft., and the ground explored. Boilers, pumps, and hoists are installed, and the shafts are properly timbered. Much effort has been expended in gophering just beneath the surface in search of the carbonate ores that can be shipped with only slight hand sorting. The irregular shipments, made by rail to Havana and thence to the United States, are costly and yield small profits. With proper financing this property may become a steady shipper in 1930.

Production by the Bethlehem Steel Company from the Daiquirí and Firmeza group of mines, on the south coast of Oriente Province, was about 230,000 tons in 1929. Shipments were approximately 600,000 tons, the excess over production being shipped from stock accumulated in previous years. Some new ore has been found in recent years at Firmeza, this prolonging somewhat the life of the south coast properties, which are said to have been operated continuously since 1884.

The company's north coast iron mines, in the Mayari district of Oriente Province, were not in operation in 1929, as sufficient nodulized ore was in stock from 1927-28 operations to supply the requirements for this class of ore. About 48,500 tons of nodulized ore was shipped to the Maryland plant of the Bethlehem Steel Company, at Sparrows Point, Md., mostly in steamers of the Ore Steamship Corporation. This is practically the same tonnage as was shipped in 1928. All shipments from Mayari are loaded at Felton, on Nipe Bay. From the same port, shipments were made of 12,842 tons of chrome ore from the Caledonia mine, which is situated near the Mayari deposit. The Caledonia mine was mined out in 1927, the shipments in 1929 being the last of a stock accumulated at Felton while the mine was in operation. No new developments occurred at the Mayari property in 1929.

Production of chrome ore by the Bethlehem Steel Company from its mines in the Camaguey district was about 40,400 tons in 1929, as compared with 22,986 tons in 1928. Shipments to the United States totaled about 42,000 tons, the excess of shipments over production coming from stock in Cuba. This production came from two mines situated near the town of Camaguey, one of which was developed in 1929. All shipments were transported over the Cuba Railroad to the shipping port, near Nuevitas, on the north coast, for delivery by steamer to the United States.

Japan

HIRONAO NISHIHARA

NO MATERIAL improvement over the previous year was recorded in the mining industry of Japan in 1929. During the twelve months' period from September, 1928, to August, 1929, inclusive, Japan produced 330,709 oz. of gold, 5,346,062 oz. of silver, 83,452,845 lb. of copper, and 71,230 tons of sulphur.

Among the individual gold mines, the Taio held the leading position, producing on a monthly average 2,142 oz. of gold; it was followed by Kushikino, of Kyushu, and Konomai, of Hokkaido, with a monthly average of 1,836 oz. and 1,401 oz. of gold, respectively.

The general business depression, which has been holding Japan in its grip for many years, apparently is affecting mining progress all over the empire. Moreover, unless some new mines are discovered in the near future, production of metals cannot be expected to improve.

The oil-shale plant reported in last year's review as under construction is nearing completion, and operations may begin early in 1930. The Anshan Iron Works produced during the twelve-month period from September, 1928, to August, 1929, inclusive, 217,046 tons of pig iron. A rumor has been prevalent lately to the effect that another iron works would be erected in Manchuria, but recent abrupt political changes in the home country seem to be responsible for some delay in putting the plan into execution.

Industrial Progress

Equipment Development Normal

NORMAL PROGRESS in development of new mining and metallurgical equipment characterized 1929. New models and designs appeared in various lines. Some were ingenious; others had little to set them apart as new from machinery already on the market. A condensed summary follows:

Drills—The trend continued toward lighter, more easily handled machines having increased drilling speed, thanks to better designs and alloys now available. Smaller machines appeared capable of producing the speed of older, larger models. One new drifter had the same bore as that of a drill made by the same manufacturer some years ago but developed three and one-half times as much energy per pound of piston hammer. This tendency was true of hand drills as well as drifters.

Ingersoll-Rand added several new models, including two self-rotated stopers, weighing 81½ and 85 lb. respectively. These machines are modifications of the latest jackhammers previously introduced. A third machine is a block-piston, hand-rotated wet stoper, weighing 93 lb. and built for speed and durability. For mounted work the company brought out three wet drifters, weighing 117, 144, and 185 lb. respectively, differing only in size, intended for close-quarter work in small headings, for average drilling conditions, and for heavy duty in hard rock. All six drills have flapper-type valves. On the three mounted drifters a new air-motor-driven feed, also new, can be used in place of the hand crank on the feed screw, this speeding up drilling by maintaining constant pressure on the steel.

A new air-line lubricator developed by Ingersoll-Rand will feed any oil or grease that will flow at the lubricator temperature and in quantity proportionate to flow of air. It will work in any position. The company also introduced an oil furnace in two sizes for heat-treating drill steel and a new wagon mounting for rock drills in quarry work.

Two hand-rotated stopers, wet and dry respectively, having tubular valves and weighing 5 to 8 lb. less than corresponding types of valveless drills, were announced by the Chicago Pneumatic Tool Company, New York. With their light weight, these combine high drilling speed (especially in hard rock), short over-all length, and the advantage of easy operation and control of air feed under difficult conditions, such as when air pressure is low, the air is wet, and parts are worn.

Gardner-Denver introduced a one-man drifter of 3-in. bore and weighing 110 lb., thus completing a line of all-purpose drifters; a light (50 lb.) all-purpose machine for wet or dry drilling; also two sinkers weighing 39 and 70 lb., the former having a reversible ratchet ring. The heavier drill is intended for deep-hole work, as in quarries. Both have an efficient and simple blowing device and an effective steel puller. A small, fast, and powerful sharpener and a noiseless oil-fired drill forge were also developed.

New types of drills brought out by Sullivan Machinery Company, Chicago, included a 58-lb. rotator in hollow-piston and water-tube models for hand-held or mounted service; two stopers, one a 62-lb. self-rotator in both wet and dry types and the other a self-rotating water machine for heavy duty in hard rock at high pressure; and new types of concrete and clay tools. This company also introduced four models of diamond-core drills for work varying from 300 to 6,000 ft. in depth. One of these will take 1⅜-in. core to 2,200-ft. depth. The heaviest will take 2-in. core to 6,000 ft.

One of the drills introduced in 1929. This sinker, mentioned above, weighs 39 lb.

Its principal achievement in 1929, states the Cleveland Rock Drill Company, Cleveland, Ohio, was in completing a series of one-man streamline drifters weighing 115, 145, and 148 lb. respectively, the third being designed for the hardest service to which a one-man drill may be subjected.

Compressors—A new line of air-cooled two-stage compressors, V-belt driven and mounted each with its motor above its receiver so as to make a compact unit, was developed by Ingersoll-Rand. These range from ¾ to 5 hp. in size, for pressures up to 200 lb. continuous duty. The design used reduces the power needed 10 to 30 per cent. Gardner-Denver introduced a compact vertical-tandem two-stage machine weighing 350 lb., and producing a continuous flow of 24 cu.ft. of air per minute up to 500 lb. Worthington Pump & Machinery Corporation, Harrison, N. J., redesigned a series of single, horizontal straight-line machines (of 100- to 350-cu.ft. capacity) to equip the main crankshaft journals with Timken bearings.

By introducing two new sizes, Sullivan Machinery Company rounded out its line of "angle-compound" machines, the range now being from 287 to 489 cu.ft. displacement. Minor changes were made in the 10-, 12-, and 14-in. stroke machines. It also added a 67-cu.ft. gasoline-engine-driven portable vibrationless compressor to the four larger machines of this type already introduced, the largest being 310 cu.ft.

Explosives — Progress was made in blasting machine design. The Du Pont company reported development by General Motors research engineers of a powerful 100-cap machine, weighing less than 36 lb. and having special electric features. Hercules Powder Company introduced a pocket-size dynamo-type machine, weighing 4¾ lb. and capable of firing ten caps in series. Makers of the 1-to-50-hole blasting machine adopted an armature shaft of porous bronze impregnated with graphite, making it practically unnecessary to oil the bearings. A semi-gelatin dynamite having the economy of high ammonia content explosive, but more plastic and water-resistant, was developed. The Hercules company also improved the smoke and fume characteristics of its Hercomite series of high-ammonia explosives, so that they compare favorably with gelatin dynamite and are adaptable to surface or underground work. Other improvements in the explosives field were made. Freezing was reported no longer a problem. A new ten-delay electric blasting cap of rigid all-metal construction and improved proportions was introduced by the Atlas Powder Company.

Transport and Haulage—Car makers

introduced several new models. The Koppel Industrial Car & Equipment Company, Koppel, Pa., furnished an automatic rolling-trunnion air-dump car of 30-cu.yd. level capacity to three Western operators. This may be had in 10- to 50-cu.yd. sizes. Body and lading are carried in stable equilibrium on center sills. On dumping the body rolls to tilt to a 45- or 50-deg. discharge angle.

Some 20-cu.yd. dump cars on 100,000-lb. trucks were built for Nevada Consolidated by Western Wheeler Scraper Company, Aurora, Ill., after the design of the drop-door car introduced prior to 1929. Weight rests directly on the draft sills and upon dual side pivots about which the body rotates to tilt to 50 deg. for dumping when air is admitted to a cylinder, the drop-door acting as an apron which projects 7 ft. beyond the track center line. The company also produced a 10-cu.yd. air dump car of the drop-door type in 36-in. gage.

Another automatic bottom-dumping car was developed by Sanford Day Iron Works, Knoxville, Tenn., its new feature being that the side sections extend over the wheels to give maxium capacity for given dimensions and are so hinged that on dumping they raise and dump their part of the load through the bottom also. Easton Car & Construction Company, Easton, Pa., supplied for power-shovel loading a strongly built 20-cu.yd. car, the body of which is in two 10-cu.yd. sections, each capable of being tipped sideways to dump independently of the other.

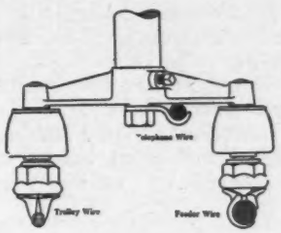
A novel combination of car and locomotive which hauls six trailer cars was introduced in two sizes by Differential Steel Car Company, Findlay, Ohio. It resulted from motorizing one of the cars and replaces the usual electric locomotive. Weight and rolling friction of the train are less than for standard locomotive and seven cars. With train loaded or unloaded, the locomotive car weighs enough to exert proper tractive pull. The heavier size weighs 40 tons unloaded and 90 tons loaded, has four 165-hp. motors, side-arm and overhead collectors, cable reel for gathering, and a 100-ft. compressor for braking and dumping. The car body is side-pivoting with down-folding doors and can be dumped to either side by a central air cylinder. The smaller size was supplied to an iron-mining company.

Two articulated tank-type coal-burning 3-ft. gage locomotives, each rated to handle 145 tons on a 7.5 per cent grade, were built by the Baldwin works to haul gilsonite over a 70-mile road in Colorado and Utah. Industrial locomotives introduced included a 25-30 ton, six-wheel gasoline locomotive from the Fate-Root-Heath Company, Plymouth, Ohio; also, a 4-ton and a 4½-ton narrow-gage gasoline locomotive from the Milwaukee Locomotive Manufacturing Company.

Haulage accessories of note included 42 special battery-charging panels built by General Electric for Anaconda for charging locomotive batteries. Ohio Brass developed a more efficient and more easily maintained headlight resistance without exposed operating parts; a triple feeder hanger affording three points of suspension from a single roof attachment; a combined trolley hanger and guard-board support; an improved mine hanger having an air gap to reduce current dissipation and a tested flashover value of 20 kv.; also, a fused trolley tap for protecting trailing cables of underground machines and their motors against burning out, the fuse smothering any arcing. Westinghouse introduced a trolley wire clamp of great holding power, proper wheel clearance, and easy to install; also a strong section insulator of superior design, and an acid-proof trolley hanger. An automatic switch thrower, operated either mechanically or electrically, was brought out by the American Mine Door Company, Canton, Ohio, and a sturdy, simple car feeder for station work by Roberts & Schaefer Company, Chicago.

Power Shovels — Despite the advantages of the 8-yd. shovel for digging ore in reach and economy per unit of material excavated, a trend toward the use of excavators of smaller capacity developed, because the latter will dig ore of different grades in the same pit without mixing and can be handled better under some conditions. Large strippers will continue useful in their own field. Another trend was toward part-swing shovels as compared with the full-revolving type, the former giving a faster operating cycle. A 5-yd. part-swing shovel representing these trends was introduced by the Marion Steam Shovel Company, Marion, Ohio.

Developments of the Bucyrus-Erie Company, South Milwaukee, Wis., included a 1-yd. Diesel shovel-crane-dragline having independent engines for each of the three motions; a ½-yd. convertible excavator driven by gasoline, Diesel, or motor; and a ¾-yd. Diesel-driven shovel of low fuel consumption. The Harnischfeger Corporation, of Milwaukee, developed seven new excavators of 1- to 3½-yd. capacity.



A triple feeder hanger affording three points of suspension from single roof attachment

Reichmann-Becker Polyp Company, Duisburg, Germany, introduced to United States users its Polyp grab bucket with multiple, flexible, independently operated blades. This runs up to 20 cu.yd. capacity and is radical in design. A 16½-cu.yd. clamshell, the world's largest, was built by G. H. Williams Company, Erie, Pa.

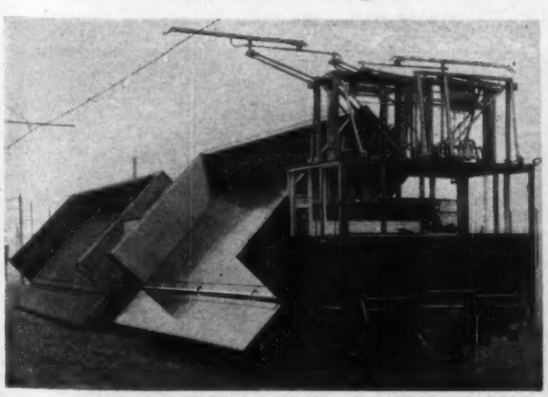
Myers-Whaley Company, Knoxville, Tenn., developed for a hydro-electric tunnel project in India a shoveling machine with the electrical equipment inclosed in water-tight compartments as a precaution against flooding; also with a traveling width of not over 4½ ft. and a traveling height not exceeding 4 ft. 10 in. It improved the lubrication of its machines by adopting Alemite fittings with direct connections to each bearing.

A land dredge of the bucket-ladder type for stripping work, developed by Lubecker Maschinenbau Gesellschafft, Lubeck, Germany, was announced in the United States.

Hoisting — Allis-Chalmers built a large double-drum hoist, the drums being of welded-plate steel construction —a new feature. The shells were made in halves, accurately rolled to diameter, welded on special automatic machines, and annealed, machined, and grooved. This welding cannot be done properly by hand, the makers assert. An additional step taken was that of making the large bed plates on these hoists also of welded steel construction. Another mine installed one of the largest hoist motors in the world, a Westinghouse d.-c. unit rating 3,200 hp., 600 volts, 79 r.p.m.

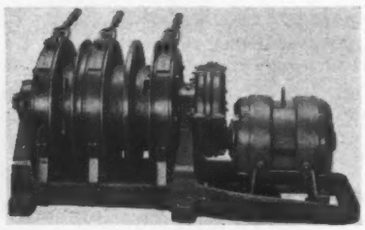
Another unique hoist was one using a gearless traction-type elevator motor, such as is used in high buildings and

A novel combination electric locomotive and car, with one trailer car



the first to be used in mining. Phelps Dodge installed this for hoisting men and ore in an 800-ft. shaft. The Nordberg company also built ten large hoists for prominent operators, including one for United Verde Copper with drums of 12 ft. diameter and 84 in. face, the largest in the Southwest. Consolidated Copper Mines, Kimberley, Nev., installed an automatic hoist (two compartments), furnished by Westinghouse, for handling skips in an 835-ft. shaft. A novel safety crosshead for shaft-sinking work was introduced by Joshua Hendy Iron Works, San Francisco.

Among miscellaneous hoists was a winch designed for raising counter-



A three-drum scraper hoist, for use with two tail blocks

weighted chutes and gates developed by Stephens-Adamson Manufacturing Company, Aurora, Ill. This company also turned out a floor-type hand-operated portable winch with 6-in. drum and 750-lb. rope pull.

Sullivan Machinery Company widened its line of portable mine hoists, adding a new Turbinair with 3-hp. motor, as compared with a 7½-hp. motor previously used on this class of hoists. Larger electric-driven hoists were also developed with 50- and 75-hp. motors for scraper work. Another new development for this work was a three-drum scraper hoist in 15, 20, and 25 hp. sizes, the center drum being the pulley drum and the two outer ones for the tail rope. This is useful where scraping is being done from a wide face where two tail blocks are used, one on either side of the face. A new line of roller sheaves intended particularly for scraper loading was introduced. The company also brought out an air (or steam) winch or cathead with 7½-hp. air motor for general service with loose rope. A compact slusher hoist, for either a.-c. or d.-c. motors up to 15 hp., which the operator can control from any position, was developed by Gardner-Denver Company, Denver, Colo.

Pumping—The two-piece runner introduced last year for its smaller pumps by A. R. Wilfley & Sons, Denver, was further perfected and this construction applied in various installations. The company introduced an extra-heavy-duty high-head sand pump in 3-in. size for handling 50 to 300 g.p.m. of abrasive pulp or sludge against discharge heads higher than heretofore considered practical and economical for centrifugal sand pumps.

For mine drainage a light, high-speed, compact volute-type multi-stage centrifugal pump for pressures up to 80 lb. was developed by Goulds Pumps, Inc., Seneca Falls, N. Y. Acquisition of Krogh Pump & Machinery Company by the Kimball Pump Company, of Los Angeles, permitted merger of the two lines, elimination of duplication and improvement from hydraulic and production viewpoints.

Other pumps introduced included a high-efficiency, ball-bearing centrifugal pump for unscreened sewage, suitable for mining company village use, developed by Worthington; a deep-well turbine in 6- and 8-in. sizes to fit smaller bored wells, from the American Well Works, Aurora, Ill.; and a stoneware-lined centrifugal pump in 225 and 500 g.p.m. sizes for handling corrosive solutions, from the U. S. Stoneware Company, New York.

Screening—The vibrating screen continued to dominate this field, some new models appearing and older ones being improved. Stephens-Adamson introduced a positively vibrated screen of sturdy design and improved construction. Smith Engineering Works, Milwaukee, developed a double-deck screen having deck movement opposed and balanced, thus confining vibration almost entirely to the decks themselves. Another screen was announced by the Productive Equipment Corporation, Chicago.

W. S. Tyler Company, Cleveland, improving its line, introduced two screens with more powerful electric vibrating mechanism for heavy duty, especially in connection with cone crushers. These had respectively twice and four times the power of the largest screen previously used for mining work. Deister Machine Company, Fort Wayne, Ind., redesigned its screen to permit building it with one, two, or three decks.

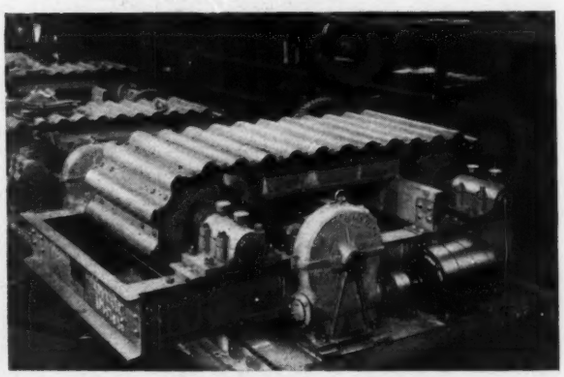
Besides producing the heaviest 50x50 mesh steel wire cloth ever made, the diameter (0.0018 in.) of the wires being larger than the nominal opening between them, Ludlow-Saylor Wire Company, of St. Louis, developed a new screen weave of large openings for severe service on vibrating screens, which is ideal, it claims, for trommels, in that it forms rigid cylinders and cones which keep their shape. It does not stretch, resists vibration, is tight, rigid, and the wires do not creep.

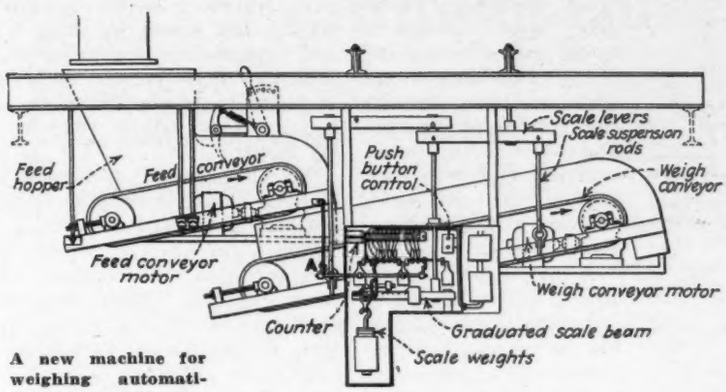
The chain feeder screen, an application of the chain feeder made by Ross Patents, Ltd., London, was introduced in the United States by Ross Screen & Feeder Company, New York.

Crushing—A 54-in. gyratory, representing a new size for its model and possibly the heaviest breaker for the size yet introduced, was built by Traylor Engineering & Manufacturing Company, Allentown, Pa. It weighs 700,000 lb. and can reduce 10,000 and more tons daily to 6-in. ring size. The company undertook to build a 56x72-in. jaw crusher, which is also a new size and the second largest jaw-type breaker yet constructed. Allis-Chalmers built specially a sectionalized 20x10 Blake-type crusher, the heaviest piece weighing 600 lb. After long testing, it also placed on a production basis a gyratory crusher (Newhouse B) of large capacity, which is self-contained, with an overhead vertical motor, and is suspended by cables from three points of the building framework. Nordberg Manufacturing Company, Milwaukee, reported a great growth in the use of cone crushers for fine crushing, having placed 36 of these machines (23 7-ft. size and 13 5½-ft.) with sixteen large companies in the United States and abroad during 1929.

Grinding—In the grinding mill field the outstanding result has been the production of low kilowatt-hour consumption per ton ground, the responsible factors being the more violent agitation produced in the grinding chamber by modifications of design; use of greater circulating load; trend to more than two-stage grinding in large flotation plants; and the greater amount of study given to correcting barrel-mill speed. Mine & Smelter Supply Company reported that the rod mill is being favored as much as at any time in the past, and that one large operator recently converted its ball mills to rod mills. Allis-Chalmers, following its building in 1928 of two 10 ft. 6 in. diameter by 8-ft. ball mills, built four more in 1929, among other grinding units supplied. Straub Manufacturing Company, Oakland, Calif., following the previous development of its so-called "Rib-Cone" mill, began to market it in 1929. Latest models have an adjustable blanking plate

Apron conveyor and feeder with integral direct-connected motor drive. **See page 153, center.**





A new machine for weighing automatically while conveying

to the grid, so that flow to the classifier can be definitely controlled.

For its wet-grinding mills the Hardinge Company, New York, developed the so-called paddle grate, consisting of four perforated scoops or paddles placed in the discharge end, which screen but do not impede the pulp passing through the grate zone, the fine material thus screened out passing out of the mill. The screen is self-cleaning. The company also introduced a regulating feeder to eliminate variations of speed due to changes in size of material, moisture, and specific gravity. It also developed a new lining in an effort to increase mill volume and decrease wear. Other grinding equipment included an impact-attrition hammer pulverizer announced by George F. Pettinos, of Philadelphia.

Blowers, Fans — Improvements in design of rotary positive blowers, according to the Connersville Blower Company, Connersville, Ind., consisted in using high-inertia impellers and better bearings to get higher speeds against increased pressure loads; also in increasing efficiencies, thereby decreasing power requirements. P. H. & F. M. Roots Company equipped its standard lines of blowers and gas pumps with roller bearings. Merger of these two companies and the Stacey and Wilbraham-Green interests was practically consummated. Coppus Engineering Corporation, Worcester, Mass., applied its portable "Heat Killer" blower to ventilating headings after blasting.

Construction of what is thought to be the largest blast-furnace blower built was begun by the De Laval Steam Turbine Company, Trenton, N. J. The unit will have a capacity of 115,000 cu.ft. per minute against 30 lb.

Conveyors, Feeders—For heavy-duty conveying Stephens-Adamson improved its Sacon carrier, equipping it with double Timken bearings, self-cleaning pulley ends, and hood-type end castings to protect the bearings. Its "444" carrier was similarly redesigned. It also supplied a South American copper company with mammoth cast-steel carriers, each weighing 1,000 lb. and mounted on four Timken bearings. Link-Belt Company, of Chicago, developed an anti-friction idler with rolls 8 in. in diameter and of $\frac{3}{8}$-in. boiler tubing for handling large tonnages of heavy ores on 30- to 60-in. belts. Robins Conveying Belt Company, of New York, brought out a three-pulley idler with demountable pulleys; improved its rubber-cushioned idler, used at conveyor loading points; devised a rubber squeegee roll for cleaning the under side of conveyor belts, and also an unusual 36-in. traveling tripper, double and reversible and discharging from either side. Allis-Chalmers applied direct-connected motor drive to its standard apron conveyor and feeder, making a self-contained, compact and variable-speed unit. It also built several continuous, overlapping pan-type feeders, 26 in. wide and 23 ft. 3 in. long, with overlapping ends on the pans.

A novel endless-chain feeder made by Ross Patents, Ltd., London, and designed to control the flow of ore in a mine or mill chute from an opening of generous size, was introduced in the United States by Ross Screen & Feeder Company, of New York. A new machine for weighing automatically while conveying was introduced by Richardson Scale Company, of New York.

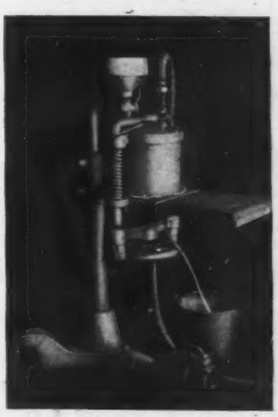
Concentration — Matless Cell Patent Holding Corporation was organized to consolidate patents of flotation cells of air-lift type, including Forrester, Hunt, Dunn, Welsch, and others, Southwestern Engineering Corporation being sole licensee and manufacturer. The latter also developed a 100-lb.-per-hour continuous flotation testing plant and adopted oil under pressure instead of water or air to operate its automatic timer and pulp samplers. Besides a filter and a rod mill of laboratory size, the Ruth Company, of Denver, introduced a multiple-tank flotation reagent feeder of the bucket type.

Development of an efficient dry concentrating table of the jig type with diagonal riffles and using air to keep the pulp in suspension was announced by Walter Duisenberg, San Francisco. It is intended for treating sands bearing precious metals. Deister Concentrator Company, of Fort Wayne, Ind., made refinements in its tables.

Classifying—Large units for classifying and thickening continued popular, according to The Dorr Company, and counter-current decantation was adopted for leaching copper oxide slimes on a scale never before approached. More attention was given to fine grinding in this connection.

A revolving screen classifier, which divides the ore charge into small portions, washes them, and hoists the oversize out of the way, to be returned to the mill or other point, was introduced by the Straub Manufacturing Company, of Oakland, Calif.

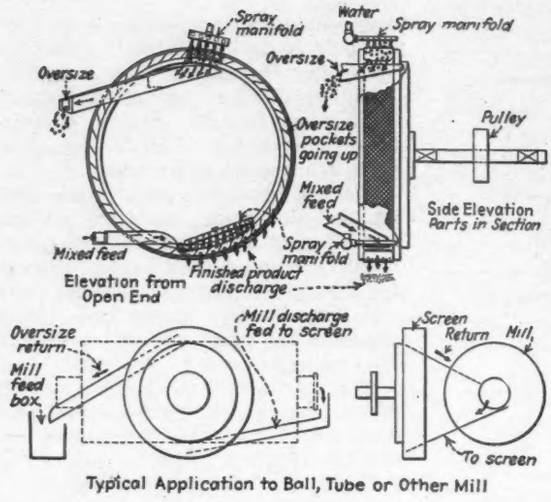
Filtration — Following the trend toward the use of vacuum filters for coarser products than could formerly be handled economically, Oliver United Filters, Inc., of San Francisco, developed a filter, which is fed at the top of the drum, the cake being discharged into the hopper underneath the drum. Where very low moisture content is wanted, the air can be heated before being drawn through the cake. On favorable materials the filter's capacities are five to twenty times those of standard vacuum filters, and the cost is lower for maintenance and power, through ability to drain and dry a much thicker cake on filter surface at greatly increased drum speed.



A filter for laboratory use. See column two, bottom.

The Dorr Company's internal-type vacuum filter was widely adopted for dewatering coarse quick-settling concentrate and initially selected for counter-current filtration. Southwestern Engineering Corporation improved its Butler filter, making the leaves thicker, reducing the filtering space between them, allowing for overflows, and adopting a special filter cloth.

Air Separation—This found increas-



Sketch of a revolving screen classifier and method of applying it. **See page 153.**

ing application in the non-metallic industries, particularly in handling diatomite and clays, according to Rubert M. Gay Company, of New York. An improved separator was introduced by Raymond Bros. Impact Pulverizer Company, of New York.

Sintering—Dwight & Lloyd Sintering Company, of New York, report a seeming tendency on part of operators to install larger units than formerly. Besides a large number of plants for sintering lead, copper, zinc, and iron ores, it supplied one for sintering phosphate rock and a machine for burning limestone, which was a modification of its sintering machine for this purpose.

Dust Collecting—Broader application of its filters to fume recovery was made by the Dust Recovery & Conveying Company, of Cleveland. It undertook to install a unit of 60 filters at the Consolidated smelter, Trail, B. C., to remove solids from flue gas from slag retreatment plant. This unit will handle approximately 105,000 cu.ft. per minute at 250 deg. C. The company developed an atmospheric cooler of new design for smelting work.

The fact that fine dust floating in a gas stream, when blasted against a rough surface, will stick to it is utilized in a dry dust collector introduced by By-Products Recoveries, Inc., of New York. The collecting elements are deeply corrugated metal plates so punched with small holes as to produce barbs on opposite side, the plates being spaced to form narrow sinuous gas passages interspersed with these barbs.

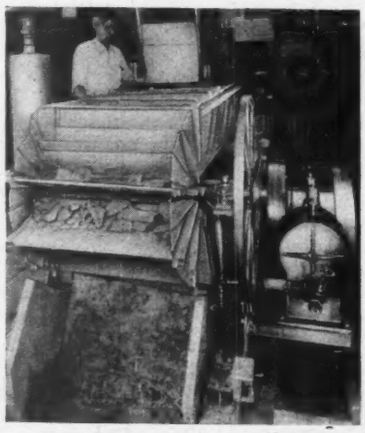
Steam Generation—If certain unusual plants be excepted, the trend in the central-station field may be said to have been toward 1,200-lb. pressure and in industrial plants toward 400 lb.

A new design for surface condensers ranging from 1,900 to 80,000 sq.ft. was developed by Worthington Pump & Machinery Corporation, of Harrison, N. J. This so-called "folded-tube layer" design is based primarily on utilizing inlet lanes to the bank of tubes forming the condensing surface, together with corresponding exit lanes leading to the air cooler offtake, a patented arrangement.

A new type of feed-water heater was also introduced by Worthington, its features being an indestructible cold-water inlet, use of counter-current heat transfer to maximum extent, improvement in tray for dividing water to be heated into drops so that scale will not prevent its functioning, better separation of oil, maximum life, and lower maintenance costs.

Electrical Generators — New large generating units developed for central-station work, though larger than any mining company's requirements, demonstrate the remarkable strides made in this field. Outstanding were the 208,000-kw. and the 160,000-kw. turbine generators turned out by General Electric; the 165,000-kw. installation made by Westinghouse; and the record-size transformers produced by the latter.

Diesel Power—Use of Diesel engines in varied size increased steadily in 1929. Commerce Mining & Royalty Company, of Oklahoma, completed its central Nordberg Diesel power plant by adding a 3,750-hp. Nordberg engine. A marked tendency toward portable units caused manufacturers to build lighter and higher-speed units. The Diesel Engine Manufacturer's Association, of New York, was organized during 1929.



Design of the Butler filter was modified. **See page 153.**

Buda Company, Harvey, Ill., operating under license from M.A.N. Company, Nürnberg, Germany, introduced a 180-hp. full Diesel weighing 5,400 lb. and designed on the airless injection principle, no compressed air being used. It also built a special Diesel engine generator (40 kw., 120-240 volt) set, weighing 10,400 lb.

An all-inclosed self-oiling gasoline-kerosene engine, developing 1½ to 7½ hp., was developed by Fairbanks, Morse & Company, of Chicago, which company also produced two compact, self-contained lighting plants, one run by gasoline (1½ hp.-750 watts) and the other by gasoline or kerosene (3 hp.-1,500 watts).

Power Transmission—Gain in popularity by short-center V-belt drives was evidenced by the introduction of two new makes, one by Fairbanks, Morse & Company, of Chicago, and another, with a cogged inner surface to insure flexibility, by Dayton Rubber Manufacturing Company, of Dayton, Ohio. Goodyear Tire & Rubber Company, of Akron, Ohio, developed a genuinely endless transmission belt with a core of cords without splice, embedded in rubber and covered by an elastic rubberized fabric envelope, the cords taking all the tension.

Bearings — Hyatt Roller Bearing Company, of Newark, N. J., began making single-row solid-roller radial bearings for use where space is limited and loads are too heavy for ball bearings. They are interchangeable with single-row ball bearings of equivalent sizes.

Instruments—The Brown Instrument Company, of Philadelphia, developed a special manometer for pressures not exceeding 1,500 lb. per square inch; introduced its electric flow meter recorders in the flush type with internal parts accessible; and developed a new line of instruments for indicating, recording, and controlling various factors at long distances. An instrument that measures heat flow with ease was introduced by the Weston Electrical Instrument Corporation, of Newark, N. J.; also a miniature transformer for measuring current from 0.2 amp. to 200 amp. A portable instrument for detecting combustible gases or vapors and indicating whether atmosphere is safe for man was introduced by the Union Carbide Sales Company, of New York.

Engineering Office — The Warren-Knight Company, of Philadelphia, introduced two new light transits of reinforced construction. Wm. Ainsworth & Sons, Inc., of Denver, improved the Brunton pocket transit, stamping a table of natural tangents on the cover, using a circular level for quicker leveling on horizontal angles and courses, and adding, when desired, the Wilson magnetometer attachment for measuring the absolute horizontal intensity of the earth's magnetic field.

Mining Directory

Professional Organizations

American Association of Petroleum Geologists, Box 1852, Tulsa, Okla.

American Chemical Society, 1709 G St., N.W., Washington, D. C.

American Electrochemical Society, Columbia University, New York.

American Institute of Mining and Metallurgical Engineers, 29 West 39th St., New York.

American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa.

Australasian Institute of Mining and Metallurgy, 48 Queen St., Melbourne, Victoria, Australia.

Canadian Institute of Mining and Metallurgy, Drummond Building, Montreal, Quebec, Canada.

Chemical, Metallurgical and Mining Society of South Africa, 100 Fox St., Johannesburg, Transvaal, South Africa.

China Institution of Mining and Metallurgy, 13 K' Vei Chia Ch' Ang, Peking, China.

Geological Society of America, Museum of Natural History, Columbus Ave., and 77th St., New York.

Geological Society of London, Burlington House, London W., England.

Geological Society of Washington, U. S. Geological Survey, Washington, D. C.

Institution of Mining and Metallurgy, 225 City Road, London E. C. 1, England.

Mining and Metallurgical Society of America, 2 Rector St., New York.

Society of Chemical Industry, Central House, Finsbury Square, London, E. C. 2, England; Pratt Institute, Brooklyn, New York.

Society of Economic Geologists, 42 Broadway, New York.

■

Educational Institutions

United States:

Alabama—Mine Experiment Station, University of Alabama, University, Ala.; J. R. Cudworth, acting director.

Alaska—Alaska Agricultural College and School of Mines, College, Alaska; C. E. Bunnell, president.

Arizona—College of Mines and Engineering, University of Arizona, Tuscon, Ariz.; G. M. Butler, dean.

California—College of Mining, University of California, Berkeley, Calif.; F. H. Probert, dean. School of Engineering, Department of Mining and Metallurgy, Stanford University, Palo Alto, Calif.; Theodore J. Hoover, dean.

Colorado—Colorado School of Mines, Golden, Colo.; M. F. Coolbaugh, president.

Connecticut—Department of Mining and Metallurgy, Yale University, New Haven, Conn.; C. H. Mathewson, professor of metallurgy; Arthur Phillips, associate professor of metallurgy; R. K. Warner and H. A. Behre, assistant professors of mining.

Idaho—School of Mines, University of Idaho, Moscow, Idaho; A. W. Fahrenwald, dean.

Illinois—Mining Engineering Department, University of Illinois, Urbana, Ill.; A. C. Callen, head.

Iowa—Mining Engineering Department, Iowa State College, Ames, Iowa; Prof. A. K. Friedrich.

Kansas—Department of Mining Engineering, University of Kansas, Lawrence, Kan.; Prof. C. M. Young, head.

Kentucky—Department of Mining and Metallurgical Engineering, C. S. Crouse, head; University of Kentucky, Lexington, Kentucky.

Massachusetts—Department of Mining and Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.; W. Spencer Hutchinson, professor of mining, in charge of the department. Harvard Engineering School, Department of Mining, Harvard University, Cambridge, Mass.; D. H. McLaughlin, professor of mining engineering.

Michigan—Michigan College of Mining and Technology, Houghton, Mich.; W. O. Hotchkiss, president.

Minnesota—School of Mines and Metallurgy, University of Minnesota, Minneapolis, Minn.; W. R. Appleby, dean.

Missouri—Missouri School of Mines and Metallurgy, Rolla, Mo.; Dr. C. H. Fulton, director.

Montana—Montana State School of Mines, Butte, Mont.; Francis A. Thomson, president.

Nevada—Mackay School of Mines, University of Nevada, Reno, Nev.; J. A. Fulton, director.

New Jersey—School of Engineering, Princeton University, Princeton, N. J.; A. M. Greene, Jr., dean.

New Mexico—New Mexico School of Mines, Socorro, N. M.; E. H. Wells, president.

New York—School of Engineering (including the School of Mines), Columbia University, New York, N. Y.; George B. Pegram, dean. Department of Geology, Cornell University, Ithaca, N. Y.; Prof. H. Ries, head.

North Dakota—College of Engineering and School of Mines, University of North Dakota, Grand Forks, N. D.; E. F. Chandler, dean.

Ohio—Department of Metallurgical and Mining Engineering, Case School of Applied Science, Cleveland, Ohio; H. M. Boylston, professor. Department of Mine Engineering, Ohio State University, Columbus, Ohio; H. E. Nold, professor.

Oklahoma—College of Engineering, University of Oklahoma, Norman, Okla.; J. H. Felger, dean. Oklahoma School of Mines and Metallurgy, Wilburton, Okla.; E. E. Tourtellotte, president.

Oregon—School of Mines, Oregon State College, Corvallis, Ore.; J. H. Hance, dean.

Pennsylvania—Department of Mining and Metallurgy, Carnegie, Institute of Technology, Schenley Park, Pittsburgh, Pa.; J. Aston, professor and head of department, and J. D. Beatty, secretary, mining and metallurgical advisory boards. Department of Mining Engineering, Lehigh University, Bethlehem, Pa.; Prof. H. Eckfeldt, head. Department of Mining Engineering, Lafayette College, Easton, Pa.; W. B. Plank, head. School of Mines, University of Pittsburgh, Pa.; E. A. Holbrook, dean. School of Mineral Industries, The Pennsylvania State College, State College, Pa.; E. Steidle, dean.

South Dakota—South Dakota State School of Mines, Rapid City, S. D.; C. C. O'Harra, president.

Texas—College of Mines and Metallurgy, University of Texas, El Paso, Tex.; C. A. Puckett, dean.

Utah—Schools of Mines and Engineering, University of Utah, Salt Lake City, Utah; R. B. Ketchum, dean.

Virginia—Department of Mining Engineering, Virginia Polytechnic Institute, Blacksburg, Va.; Prof. O. C. Burkhart, head. Corcoran and Rogers School of Geology, University of Virginia, Charlottesville, Va.; Wilbur A. Nelson, head.

Washington—College of Mines, University of Washington, Seattle, Wash.; Milnor Roberts, dean. School of Mines and Geology, State College of Washington, Pullman, Wash.; A. E. Drucker, dean.

West Virginia—School of Mines, West Virginia University, Morgantown, W. Va.; Prof. C. E. Lawall, head.

Wisconsin—Department of Mining and Metallurgy, University of Wisconsin, Madison, Wis.; Prof. R. S. McCaffery, chairman. Wisconsin Mining School, Platteville, Wis.; H. B. Morrow, director.

Wyoming—Department of Mining Engineering, University of Wyoming, Laramie, Wyo.; Prof. J. R. Guitéras, head.

Other Countries:

Argentine—Universidad de Buenos Aires, Buenos Aires; Universidad Nacional del Litoral, Rosario; Escuela de Minas, Catamarca; Escuela de Minas, Mendoza; Escuela de Minas, Jujuy.

Australia—University of Sydney, Sydney, New South Wales; University of Melbourne, Melbourne, Victoria; University of Queensland, Brisbane, Queensland; University of Adelaide, Adelaide, South Australia; University of Western Australia, Perth, Western Australia; School of Mines, Ballarat, Victoria; University of Tasmania, Hobart, Tasmania.

Austria—Montanistische Hochschule, Leoben.

Bolivia—Escuela Nacional de Minas, Oruro.

Brazil—Escola Polytechnica de São Paulo, São Paulo; Escola Polytechnica do Rio Grande do Sul, Porto Alegre; Escola Polytechnica do Rio de Janeiro, Rio de Janeiro; Escola de Minas de Ouro Preto, Ouro Preto, Minas Geraes.

British Isles: ENGLAND—University of Birmingham, Birmingham; University of Cambridge, Cambridge; University of Leeds, Leeds; University of Liverpool, Liverpool; The Royal School of Mines, Imperial College, University of London, London; University of Manchester, Manchester; University of Nottingham, Nottingham; University of Sheffield, Sheffield; School of Metalliferous Mining, Camborne, Cornwall; Armstrong College, Newcastle-upon-Tyne.
WALES—University College of Wales, Aberystwyth; University College of South Wales and Monmouthshire, Cardiff; University College of Swansea, Swansea.
SCOTLAND—Heriot Watt College, University of Edinburgh, Edinburgh; Royal Technical College, University of Glasgow, Glasgow; Hamilton Technical School, Hamilton, Lanark; Coatbridge Technical School and Mining College, Coatbridge, Lanark; County Mining School, Falkirk; W. M. Ramsey Technical Institute, Edinburgh; Robert Gordon's Technical College, Aberdeen.
IRELAND—Queen's University, Belfast, Northern Irelond.

Bulgaria—Sofia University, Sofia; Tsar Boris State Technical School, Sofia.

Canada—Nova Scotia Technical College, Halifax, Nova Scotia; Dalhousie University, Halifax, Nova Scotia; Acadia University, Wolfville, Nova Scotia; University of St. Francis Xavier, Antigonish, Nova Scotia; University of New Brunswick, Fredericton, New Brunswick; Mount Allison University, Sackville, New Brunswick; University of Toronto, Toronto, Ontario; Queen's University, Kingston, Ontario; McGill University, Montreal, Quebec; University of Manitoba, Winnipeg, Manitoba; University of Saskatchewan, Saskatoon, Saskatchewan; University of Alberta, Edmonton, Alberta; University of British Columbia, Vancouver, British Columbia.

Chile—Escuela de Ingenieria, University of Chile, Santiago; Catholic University of Santiago, Santiago; Escuela de Mineria, Copiapó; Escuela de Mineria, La Serena; Escuela de Salitre de Antofagasta, Antofagasta.

China—Nankai University, Tientsin; North Western University, Peiping; Peiyang University, Tientsin; National Government University, Peiping.

Colombia—Universidad Nacional, Bogota; Instituto Tecnico Central, Bogota; Universidad del Cauca, Popayan; Universidad de Narino, Pasto; Facultad Nacional de Minas, Medellin.

Cuba—University of Havana, Havana.

Czechoslovakia—College of Mining, Pribram, Bohemia; Czech Poltechnical School, Prague; German Polytechnical School, Prague; Czech Polytechnical School, Brno; German Polytechnical School, Brno.

Denmark—The University of Copenhagen, Copenhagen.

Ecuador—Central University of Quito, Quito.

Egypt—Egyptian University, Faculty of Sciences, Cairo.

Estonia—Tallinna Tehnikum, Tallinn; E. V. Tartu Ulikool, Tartu.

France—Ecole Nationale Supérieure des Mines, Paris; Ecole Nationale Supérieure des Mines de Saint-Etienne, St. Etienne; Ecole Supérieure de Métallurgie et d'Industrie Miniere de l'Université de Nancy, Nancy; Ecole Centrale des Arts et Manufactures, Paris; Ecole Polytechnique, Paris; Conservatoire National des Arts et Metiers, Paris; Ecole des Maitres-mineurs d'Alès, Alès; Ecole des Maitres Mineurs de Douai, Douai; Université de Paris, (Sorbonne), Paris; Université d'Aix, Marseille; Université de Besançon, Besançon; Université de Bordeau, Bordeau; Université de Caen, Caen; Université de Clermont-Ferrand, Clermont-Ferrand; Université de Grenoble, Grenoble; Université de Dijon, Dijon; Université de Lille, Lille; Université de Lyon, Lyon; Université de Montpellier, Montpellier; Université de Rennes, Rennes; Université de Toulouse, Toulouse; Université de Strasbourg, Strasbourg.

Finland—Teknillinen Korkeakoulu (The Technical University), Helsinki; Abo Akademi (Abo Academy), Abo; Helsingin Yliopisto (The University of Helsinki), Helsinki.

Germany—Berg Akademie (Mining Academy), Freiberg, Saxony; Berg Akademie, Clausthal, Upper Silesia; Technische Hochschulen (Technical High Schools) at Berlin, Aachen, Breslau, Braunschweig, Darmstadt, Dresden, Hannover, Karlsruhe, Muenchen, Stuttgart.

Greece—University of Athens, Athens; University of Saloniki, Saloniki; Metsovian School of Arts, Athens.

India—Presidency College, Calcutta; Bengal Engineering College, Howrah; Suresh Chandra Inste-School of Mines, Ethora; College of Engineering, Poona; Prince of Wales College, Jammu; Benares Hindu University, Benares; Central College, Bangalore; Rangoon University, Rangoon.

Italy—Royal School of Engineering, Rome; Royal School of Engineering, Torino; Royal School of Engineering, Palermo.

Japan—Tokio Imperial University, Tokio; Kyoto Imperial University, Kyoto; Tohoku Imperial University, Sendai; Kyushu Imperial University, Fukuoka; Hockaido Imperial University, Sapporo; Ryojun Technological University, Ryojun, Port Arthur; Osaka Technological University, Osaka; Waseda University, Tokio; Akita Mining and Metallurgical College, Akita; Meiji Senmon College, Tobata; Kumamoto Higher Technological College, Kumamoto; Keijo Higher Technological College, Keijo, Seoul.

Latvia—Latvijas Universitate (University of Latvia), Riga; Valsts Technikums (State Technical School), Riga.

Mexico—Colegio de Estato, Guanajuato, Guanajuato; Escuelas de Ingenieros, Mérida, Yucatan; Escuelas de Ingenieros, Morélia, Michoacan; Escuela de Mineria de Guadalajara, Guadalajara, Jalisco; Escuela de Mineria de Guanajuato, Guanajuato, Guanajuato; Escuela de Mineria de Mexico, Mexico, D. F.; Escuela de Mineria de San Luis Potosi, San Luis Potosi, San Luis Potosi; Escuela Nacional de Maestros, Zacatecas, Zacatecas; Ingenieros Agrónimos, Leon, Guanajuato; Instituto Geológico, Mexico, D. F.; Instituto Juarez, Villahermosa, Tabasco; Universidad Nacional de Mexico, Mexico, D. F.

Netherlands—University of Amsterdam, Amsterdam; Technische Hoogschool, Delft; Rijksuniversiteit, Groningen; Rijksuniversiteit, Leiden; Rijksuniversiteit, Utrecht; Roman Catholic University, Nijmegen.

Norway—Mineralogical Institute of the University of Norway, Oslo; Institute of Technology of Norway, Nidaros.

Panama—National Institute, Panama City; La Salle College, Panama City.

Peru—Escuela de Ingenieros, Lima.

Poland—Akademja Górnicza w Krakpwie (Mining Academy in Krakow), Krakow; Politechnika Warszawska (Polytechnic Institute in Warsaw), Warsaw; Politechnika Lwowska (Polytechnic Institute in Lwów), Lwów.

Portugal—Instituto Superior Tecnico, Lisbon; Instituto Superior de Agronomia, Lisbon; Instituto Industrial de Lisboa, Lisbon; Faculdade de Sciencias da Universidade de Lisboa, Lisbon; Universidade do Porto, Oporto; Institudo Industrial e Comercial, Oporto; Faculdade de Sciencias do Universidade de Coimbra, Coimbra.

Siam—Chulalankarana University, Bangkok.

South Africa—University of the Witwatersrand, Johannesburg; University of Stellenbosch, Stellenbosch; University of Cape Town, Groote Schuur; Transvaal University College, Pretoria; Grey University College, Bloemfontein; Rhodes University College, Grahamstown; Natal University College, Maritzburg.

Spain—Escuela Especial de Ingenieros de Miñas, Madrid; Escuela de Ingenieros Industriales, Barcelona; Instituto Geológico y Minero de Espana, Madrid; Escuela Central de Ingenieros Industriales, Madrid; Escuela Industrial, Madrid; Universidad de Barcelona, Barcelona; Universidad de Granada, Granada; Universidad de Oviedo, Oviedo; Universidad de Salamanca, Salamanca; Universidad de Santiago, Santiago; Universidad de Sevilla, Sevilla; Universidad de Valencia, Valencia; Universidad de Zaragoza, Zaragoza.

Sweden—University of Upsala, Upsala; University of Lund, Lund; Stockholm University, Stockholm; School of Mining, The Royal Institute of Technology, Stockhom; Chalmers Technological Institute, Gothenburg.

Switzerland—University of Basel, Basel; University of Berne, Berne; University of Fribourg, Fribourg; University of Geneva, Geneva; University of Lausanne, Lausanne; University of Neuchatel, Neuchatel; University of Zurich, Zurich; Federal Institute of Technology, Zurich.

Turkey—Université de Constantinople, Bayazid, Constantinople; Ecole des Ingénieure, Gumush-Suyu, Constantinople; Ecole des Mines d'Héraclée, Zonguldak.

Union of Socialist Soviet Republics—Leningrad Mining Institute, Leningrad; Dniepropetrovsk Mining Institute, Dniepropetrovsk; Moscow Mining Academy, Moscow.

Uruguay—Facultad de Ingeniería, Universidad de Montevideo, Montevideo.

Venezuela—Universidad de Caracas, Caracas; Universidad de Mérida, Mérida.

Yugoslavia—Visoka Rudarska Skola Ljubljanskog (School of Mines of Ljubljana University), Ljubljana; Srednja Rudarska Skola (Trade School of Mines), Celje, Sloenija.

■

Government Departments and Bureaus

U. S. Bureau of Mines:

Washington, D. C.—Scott Turner, Director; Joseph H. Hedges, assistant to the director.

Technologic Branch—Ozni P. Hood, chief and chief engineer mechanical division; Harry C. Fowler, acting chief engineer, petroleum and natural gas division; Roscoe A. Cattell, chief engineer, helium division; Charles W. Wright, chief engineer, mining division; Arno C. Fieldner, chief engineer, experiment stations division; Reginald S. Dean, chief engineer, metallurgical division; Charles E. Munroe, chief engineer, explosives division.

Field Stations—Harry F. Yancey, acting supervising engineer, Seattle, Wash.; Henry H. Storch, supervising engineer, New Brunswick, N. J.; Will H. Coghill, supervising engineer, Rolla, Mo.; Chauncey F. Cook, supervising engineer, Amarillo, Tex.; Eugene D. Gardner, supervising engineer, Tucson, Ariz.; Thomas L. Joseph, supervising engineer, Minneapolis, Minn.; Byron M. Bird, supervising engineer, Birmingham-Tuscaloosa, Ala.; Edmund S. Leaver, supervising engineer, Reno, Nev.; Dorsey A. Lyon, supervising engineer, Salt Lake City, Utah; Charles G. Maier, acting supervising engineer, Berkeley, Calif.; Nicholas A. C. Smith, supervising engineer, Bartlesville, Okla.; George St. J. Perrott, superintendent, Pittsburgh, Pa., station.

Field Offices—Clifford P. Bowie, supervising engineer, San Francisco, Calif.; ————, supervising engineer, Moscow, Idaho; Harry B. Hill, supervising engineer, Dallas, Tex.; Joseph W. Horne, engineer-in-charge, Boulder, Colo.; Kenneth B. Nowels, supervising engineer, Laramie, Wyo.; Benjamin D. Stewart, supervising engineer, in charge of Alaskan work (by courtesy of Geological Survey, Department of the Interior).

Economics Branch—Charles P. White, chief and head of coal division; Frank J. Katz, chief engineer, mineral statistics division; Frank L. Hess, chief engineer, rare metals and non-metals division; Edward B. Swanson, acting chief engineer, petroleum economics division; Carl E. Julihn, chief engineer, common metals division.

Field Offices—John P. Dunlop, supervising statistician, Joplin, Mo.; Victor C. Heikes, supervising engineer, Salt Lake City, Utah; Charles W. Henderson, supervising engineer, Denver, Colo.; ———— ————, supervising engineer, San Francisco, Calif.

Health and Safety Branch—R. R. Sayers, chief and chief surgeon, health division; Daniel Harrington, chief engineer, safety division.

Field Offices—Frank E. Cash, supervising engineer, Birmingham, Ala.; Edward H. Denny, supervising engineer, Denver, Colo.; John J. V. Forbes, supervising engineer, instruction section, Pittsburgh, Pa.; Frank S. Crawford, supervising engineer, Duluth, Minn.; Charles A. Herbert, supervising engineer, Vincennes, Ind.; Dorsey J. Parker, supervising engineer, Salt Lake City, Utah; Frank V. Meriwether, acting assistant surgeon, Picher, Okla.; Arthur L. Murray, acting assistant surgeon, Salt Lake City, Utah; Charles P. Waite, acting assistant surgeon, Pittsburgh, Pa.

Administrative Branch—Joseph H. Hedges, chief; John A. Davis, chief engineer, information division; John D. Secrest, chief clerk and head, office of chief mining engineer—George S. Rice, engineer.

U. S. Geological Survey:

Director, Dr. G. O. Smith; Administrative Geologist, J. D. Sears; Chief Clerk, J. J. Madigan; Geologic Branch, W. C. Mendenhall; Alaskan Branch, P. S. Smith; Topographic Branch, J. G. Staack; Water-Resources Branch, N. C. Grover; Conservation Branch, Herman Stabler; Editor, B. H. Lane.

Other Countries:

Argentine—Dirección General de Minas Geologia é Hidrologia, Buenos Aires.

Australia—The Geological Survey, Sydney, New South Wales; Department of Mines, Sydney, New South Wales; Department of Mines, Melbourne, Victoria; Department of Mines, Brisbane, Queensland; Department of Mines, Perth, Western Australia; Department of Mines, Adelaide, South Australia; Department of Mines, Hobart, Tasmania.

Austria—Bundesministeriumfuer Handel und Verkehr, Oberste Bergbehoerde, Wien.

Bolivia—Dirección General de Minas y Planos Mineros, La Paz.

Brazil—Serviço Geologico e Mineralogico, Ministerio da Agricultura, Rio de Janeiro; Serviço Geologico do Estado de S.io Paulo São Paulo; Serviço Geologico do Estado de Minas Geraes, Bello Horizonte, Minas Geraes.

Bulgaria—Ministry of Commerce, Industry, and Labor, Sofia.

Canada—Department of Mines, Ottawa, Ontario; Department of Public Works and Mines, Halifax, Nova Scotia; Department of Lands and Mines, Fredericton, New Brunswick; Department of Mines, Toronto, Ontario; Bureau of Mines, Quebec, Quebec; Department of Mines and Natural Resources, Winnipeg, Manitoba; Bureau of Labour and Industries, Regina, Saskatchewan; Mines Branch, Edmonton, Alberta; Scientific and Industrial Research Council, Edmonton, Alberta; Department of Mines, Victoria, British Columbia.

Chile—Superintendencia de Salitre y Minas, Santiago.

China—Ministry of Agriculture and Mining, Nanking; Government Geological Bureau, Nanking.

Colombia—Ministerio de Industrias, Seccion Tecnica de Minas y Petroleo, Bogota.

Cuba—Bureau of Forests and Mines, Department of Agriculture, Commerce and Labor, Havana.

Czechoslovakia—Ministry of Public Works, Prague.

Denmark—Danmarks Geologiske Undersøgelse (Geological Survey of Denmark), Copenhagen; Geologiske og Geografiske Undersøgelser i Gronland (Geological and Geographical Survey of Greenland), Copenhagen.

Egypt—Department of Mines and Quarries, Cairo; Geological Department, Cairo.

Estonia—Maeosakond, Majanduseministeerium, Tallinn.

Finland—Geologinen Toimisto (The Geological Commission), Helsinki.

France—Direction des Mines, Ministère des Travaux Publics, 244 Boulevard Saint-Germain, Paris; Service de la Carte Geologique Détaillée de la France, Ministère des Travaux Publics, 62 Boulevard Saint-Michel, Paris.

Germany—Prussian Ministry of Commerce and Industry, Mining Section, Berlin; Geological State Survey, Berlin.

Great Britain—The Mines Department, Dean Stanley St., London, S.W. 1; Geological Survey of Great Britain, 28 Jermyn St., London, S.W. 1.

Greece—Bureau of Mines, Ministry of National Economy, Athens.

Guatemala—Direccion General de Mineria, Guatemala.

Honduras—Sección de Tierras y Mineria, Ministerio de Fomento, Tegucigalpa.

India—Geological Survey of India, Calcutta; Chief Inspector of Mines in India, Dhanbad.

Italy—Corpo Reale delle Miniere (Royal Mining Bureau), Rome; Reale Ufficio Geologico (Royal Geological Bureau), Rome.

Japan—Mining Bureau, Department of Commerce and Industry, Tokio; Geological Survey of Japan, Department of Commerce and Industry, Tokio.

Mexico—Departamento de Minas, Secretaria de Industria, Comercio y Trabajo, Mexico, D. F.

Netherlands—Sectie Mijnwegen, Department van Waterstaat, The Hague; Rijks Geologische Dienst, Department van Waterstaat, Haarlem.

Norway—Norges Geologiske Undersökelse (Geological Survey of Norway), Oslo; Statens Raastoffkomité (Government Bureau of Natural Resources), Oslo.

Panama—Department of Agriculture and Public Works, Panama.

Peru—Dirección de Minas y Petroleo, Ministerio de Fomento, Lima.

Poland—Ministerstwo Przemyslu i Handlu (Ministry of Commerce and Industry), Department II Górniczo-Hutniczy (Department of Mining and Metallurgy), Warsaw.

Portugal—Direcção Geral de Minas a Serviços Geologicos, Ministerio do Comercio, Lisbon.

Siam—Royal Department of Mines and Geology, Bangkok.

South Africa—Department of Mines and Industries, Pretoria.

Spain—Dirección General de Minas y Combustibles (Bureau of Mines and Fuels), Ministerio de Fomento, Madrid.

Sweden—Geological Survey of Sweden, Department of Agriculture, Stockholm.

Switzerland—Departement des Innern, Bern.

Turkey—Direction Générale des Mines Ministère de l'Economie, Angora.

Union of Socialist Soviet Republics—Directory of the Mining Industry, Chief Mining and Fuel Administration of the Supreme Economic Council, Moscow; The State Geological Survey, Leningrad.

Uruguay—Inspección de Minas é Industrias, Montevideo.

Yugoslavia—Drzavni Geoloski Zavod (Chief Geological Section), Generalna Rudarska Direkcija (General Mining Bureau), Sarajevo, Bosnia.

■

Trade Associations

United States:

General—American Bureau of Metal Statistics, 33 Rector St., New York; American Mining Congress, 841 Munsey Building, Washington, D. C.; California Metal and Mineral Producers' Association, San Francisco; Chamber of Commerce and Mines, Douglas, Ariz.; Chamber of Mines and Oil, Los Angeles, Calif.; Nevada Mine Operators' Association, Reno, Nev.; Northwest Mining Association, Spokane, Wash.

Copper—Copper and Brass Research Association, 25 Broadway, New York; Copper Exporters, Inc., and The Copper Institute, 25 Broadway, New York.

Feldspar—Feldspar Grinders' Institute, Inc., 7 East 44th St., New York.

Gypsum—Gypsum Institute, 110 West 40th St., New York.

Iron and Steel—American Iron and Steel Institute, 506 Evening Post Building, 75 West St., New York; Association of American Steel Manufacturers, Pittsburgh, Pa.; Lake Superior Iron Ore Association, Cleveland, Ohio.

Lead—Lead Industries Association, F. E. Wormser, secretary, 420 Lexington Ave., New York.

Limestone, Lime—National Agstone Association, Hartman Building, Columbus, Ohio; National Lime Association, 927 Fifteenth St. N.W., Washington, D. C.

Manganese—American Manganese Producers' Association, Metropolitan Bank Building, Washington, D. C.

Petroleum—American Petroleum Institute, 250 Park Ave., New York.

Phosphate Rock—Phosphate Export Association, 420 Lexington Ave., New York.

Portland Cement—Portland Cement Association, 347 Madison Ave., New York.

Refractories—American Refractories Institute, 2218 Oliver Building, Pittsburgh, Pa.

Sand and Gravel—National Sand and Gravel Association, Suite 545 Munsey Building, Washington, D. C.

Slate—National Slate Association, W. S. Hays, Secretary, 644 Drexel Building, Philadelphia, Pa.

Stone—National Crushed Stone Association, Merchandise Building, Washington, D. C.

Tin—American Tin Trade Association, 82 Wall St., New York.

Zinc—American Zinc Institute, 27 Cedar St., New York.

Other Countries:

Australia—Australian Mines & Metals Association, Melbourne, Victoria; Zinc Producers' Association, Melbourne, Victoria.

Bolivia—Asociación de Industriales Mineros, La Paz; Asociación de Industriales Mineros, Oruro.

Brazil—Associação do Industriaes Metallurgicos, São Paulo.

Canada—Ontario Mining Association, Northern Ontario Building, Toronto, Ontario; Northwest Ontario Chamber of Mines, 19 Francis Block, Fort William, Ontario; Manitoba Chamber of Mines, 203 Montreal Trust Building, Winnipeg, Manitoba; Industrial Development Board of Manitoba, Winnipeg, Manitoba; British Columbia Chamber of Mines, 402 West Pender St., Vancouver, British Columbia; Mining Association of British Columbia, 718 Granville St., Vancouver, British Columbia; Mining Association of Interior of British Columbia, Nelson, British Columbia.

Chile—Sociedad Nacional de Mineria, Santiago.

Czechoslovakia—The Czechoslovak Metallurgical Association, Prague; The Czechoslovak Mine Owners Association, Prague.

France—Groupement 9 de la Conféderation Générale de la Production française, Industries minieres, 35 rue Saint-Dominique, Paris; Union des Industries métallurgiques & Minières, 7 rue de Madrid, Paris; Chambre Syndicale du Commerce des Métaux, 163 rue St. Honoré, Paris.

Germany—Fachgruppe Bergbau des Reichsverbandes der Deutschen Industrie (Mining Section of the State Association of German Industries), Berlin; Metallhuettenverband (Smelter Association), Berlin.

Great Britain—London Metal Merchants Association, London; Mineral Owners Association of Great Britain, London; British Metal Trades Federation, Sheffield; British Lead & Zinc Mine Owners Association, London; Federated Quarry Owners of Great Britain, Halifax; British Zinc Smelters Conference, London.

India—The Indian Mining Association, Calcutta.

Italy—Federazione Nazionale Fascista dell' Industria Mineraria (National Fascist Federation of Mining Industries), Milano; Federazione Nazionale Fascista, dell' Industria Meccanica e Metallurgica (National Fascist Federation of Mechanical and Metallurgical Industries), Milano.

Japan—Nihon Kogyo Kai (Society of the Japanese Mining Industry), Tokio; Kozan Konwa Kai (Japanese Mining Association), Tokio; Suiyo Kai (Copper Trade Association) Tokio.

Norway—Bergverkernes Landssammenslutning (Mining Association), Oslo; Graniteksportörernes Forening (Granite Exporters Association), Halden; Ostlandske Stenindustriforening (Association of Eastern Quarry Operators), Oslo.

Poland—Polski Zwiazek Przemyslowców Metalowych (Association of Polish Metallurgical Industries), Warsaw; Górnosiaski Zw. Przemyslowców Górniczo-Hutniczych (Union of Upper Silesian Industrialists of Mines and Foundries), Katowice, Upper Silesia.

Portugal—Associação Industrial Portuguesa, Lisbon.

South Africa—Transvaal Chamber of Mines, Johannesburg.

Spain—Asociacion Patronal de Mineros, Madrid.

Sweden—Bergshandteringens (Friends of the Mining Industry), Stockholm.

Turkey—Turk Maadenjilar Birgligi (Mining Association of Turkey), Galata, Constantinople.

Union of Socialist Soviet Republics—All-Union Syndicate of the Non-Ferrous Metal Industry, Moscow.

Note: In the foregoing directory, material for the United States was obtained direct from the respective agencies concerned. Material for the other countries was received from the American Consular Service; U. S. Bureau of Foreign and Domestic Commerce; and consuls general, trade commissioners, and commercial attachés representing the various countries.

Mining Dividends Paid in 1928 and 1929

Compiled by *Engineering and Mining Journal*

Official data supplied by individual companies except when indicated by an asterisk (*) in which case it is from published reports

Company, Metals Mined, and Class of Stock	Situation	Shares Outstanding	Par Value	1928 Per Share	1928 Total	1929 Per Share	1929 Total	Total Paid to End of 1929	Latest Dividend Paid to Dec. 31, 1929 Date	Per Share
Mines in the United States										
American Metal	Various	868,163a	No	$3.00	$1,785,245	$3.00	$2,382,907	$41,708,249	Dec., 1929	0.75
American Metal, 6% pfd.b	Various	68,436	$100	6.00	520,100	6.00	450,552	.....	Dec., 1929	1.50
*American Smelting & Refining	Various	1,829,940c	No	8.00	4,879,840	4.00	7,319,760	.....	Nov., 1929	1.00
*American Smelting & Refining, pfd.	Various	500,000	100	7.00	3,500,000	7.00	3,500,000	.....	Dec., 1929	1.75
*American Zinc, Lead & Sm., pfd.	Tenn.	80,328	25	.....	.....	3.00	240,984	.....	Oct., 1929	1.50
*Amethyst Leasing, s	Colorado	8	400	.....	.....	7,000	56,000	56,000	June, 1929	800
Anaconda Copper	Montana	8,768,233d	50	3.50	11,195,073	6.75	43,550,297	265,508,495	Nov., 1929	1.75
*Arizona Commercial, c	Arizona	265,000	5	0.25	66,250	0.50	132,500	.....	July, 1929	0.25
*Bingham Mines	Utah	50,000e	10	3.25	162,500	1.00	50,000	.....	April, 1929	0.50
Bunker Hill & Sullivan, s, l, z	Idaho	327,000	10	9.00	294,300	9.00	294,300	45,781,552	Dec., 1929	0.75
Bunker Hill & Sullivan, pfd	Idaho	7,657	100	9.00	60,962	9.00	66,036	.....	Oct., 1929	2.25
*Butte Copper & Zinc	Montana	60,000	5	.....	.....	0.50	300,000	.....	Dec., 1929	0.50
Butte & Superior, z, c	Montana	290,197	10	2.00	580,395	2.00	580,395	20,277,531	Dec., 1929	0.50
*California Rand, s	California	1,280,000	1	0.06	77,800	.....	.....	4,595,600	Nov., 1928	0.01
Calumet & Arizona Mining, new, c	Arizona	842,857f	20	.....	.....	7.50	6,321,428	6,321,428	Dec., 1929	2.50
Calumet & Arizona Mining, old, c	Arizona	642,757	10	7.00	4,499,299	1.75	964,136	67,482,019	Mar., 1929	1.75
*Calumet & Hecla, c	Michigan	2,005,502	25	2.50	5,013,775	4.50	9,024,840	26,071,607	Dec., 1929	1.50
Chief Consolidated, s, l, z	Utah	1,142,860	1	0.10	114,286	.....	.....	3,654,519	Feb., 1928	0.10
Consolidated Lead & Zinc	Tri-State	250,000	No	0.50	100,000	1.00	250,000	805,000	Oct., 1929	0.25
Copper Range, c	Michigan	394,755	25	1.00	394,755	2.00	789,510	30,550,410	Oct., 1929	0.50
Cresson Consolidated, g	Colorado	1,220,000	1	0.32	390,400	0.08	97,600	12,247,072	Oct., 1929	0.02
Dayrock Mining, s, l	Idaho	1,692,300	0.10	.....	.....	0.12	203,076	203,076	Dec., 1929	0.03
Eagle-Picher Lead, l, s, z	Tri-State, Ariz.	1,000,000	20	.....	.....	0.40	400,000	11,223,383	Oct., 1929	0.20
Eagle-Picher Lead, pfd	Tri-State, Ariz.	8,445	100	6.00	51,078	6.00	51,078	.....	Oct., 1929	1.50
*East Butte Copper	Montana	424,887	10	.....	.....	0.25	106,222	.....	Dec., 1929	0.25
*Federal Mining & Smelting, s, l, s, pfd.	Various	72,000	100	7.00	504,000	7.00	504,000	.....	Dec., 1929	1.75
*Freeport Texas, su	Texas	729,884	No	6.50	4,743,986	4.00	2,919,376	.....	Nov., 1929	1.00
Golconda Lead, l, s, s	Idaho	2,000,000	1	.....	.....	0.04	80,000	80,000	July, 1929	0.02
Golden Cycle Corporation, g	Colorado	165,000	10	0.16	240,000	0.88	252,000	11,124,300	Dec., 1929	0.40
Hecla Mining, l, s, z	Idaho	1,000,000	0.25	0.70	700,000	0.90	900,000	18,705,000	Dec., 1929	0.25
Homestake Mining, g	South Dakota	251,160	100	6.00	1,506,960	6.00	1,506,960	55,357,084	Dec., 1929	0.50
Idawa Gold	Idaho	800,000	0.25	0.07	56,000	0.03	24,000	80,000	July, 1929	0.03
*Inspiration Consolidated, c	Arizona	1,181,967	20	.....	.....	3.75	4,592,376	50,378,387	Nov., 1929	1.00
*Isle Royale Copper	Michigan	150,000	25	1.75	262,500	2.00	300,000	3,412,500	Dec., 1929	0.50
*Kennecott Copper	Alaska, Chile	9,372,123g	No	5.25	23,806,867	4.50	41,025,850	193,619,937	Oct., 1929	1.25
Lone Pine Surprise Consolidated, s, g	Washington	3,126,000	0.03	0.02	62,520	.....	.....	.....	July, 1928	0.01
*Magma Copper	Arizona	408,155	No	3.00	1,224,465	4.75	1,938,736	7,928,364	Oct., 1929	1.25
*Miami Copper	Arizona	747,116	5	1.50	1,120,674	3.50	2,614,906	35,558,223	Nov., 1929	1.00
*Mohawk Mining, c	Michigan	115,000	25	6.00	690,000	8.00	920,000	13,610,000	Dec., 1929	3.00
Mother Lode Coalition, c, s, g	Alaska	2,500,000	No	0.35	875,000	0.40	1,000,000	13,750,000	Dec., 1929	0.20
National Lead	Various	309,831	100	5.00	1,549,155	5.00	1,549,155	85,053,618.75	Dec., 1929	.....
National Lead, pfd., A	Various	243,676	100	7.00	1,705,732	7.00	1,705,732	.....	Dec., 1929	1.75
National Lead, pfd., B	Various	103,277	100	6.00	619,662	6.00	619,662	.....	Nov., 1929	1.50
*Nevada Consolidated, c, s, g	Various	4,855,109	No	1.625	7,889,552	3.00	14,565,327	83,641,186	Dec., 1929	0.75
New Cornelia, c	Arizona	1,800,000h	5	2.00	3,600,000	0.50	900,000	18,630,000	Feb., 1929	0.50
New Jersey Zinc	Various	1,963,264i	25	12.00	5,889,792	4.00	7,853,056	.....	Dec., 1929	1.00
*New Quincy Mining, s, l	Utah	1,400,000	0.10	.....	.....	0.20	280,000	280,000	Sept., 1929	0.10
Newmont Mining	None	504,224	10	4.00	1,884,784	4.00	1,989,980	6,901,260	Oct., 1929	1.00
Night Hawk Leasing, c	Arizona	100,000	1	0.65	65,000	0.10	10,000	535,000	Sept., 1929	0.10
*North Lily, s, l	Utah	795,550	0.10	0.20	159,110	1.00	795,550	954,660	Oct., 1929	0.25
Park Utah Consolidated, s, l, s	Utah	2,093,500	1.00	0.80	1,674,000	0.60	1,256,100	37,732,862	July, 1929	0.20
*Phelps Dodge, c, s, g, l	Arizona, Mexico	2,000,000i	25	7.00	3,500,000	2.75	5,500,000	.....	Oct., 1929	0.75
*Plutus Mining, s, l	Utah	997,145	0.10	0.10	99,715	.....	.....	997,145	April, 1928	0.10
*Rico Argentine, s, l	Colorado	800,000	0.10	0.06	48,000	.....	.....	.....	June, 1928	0.03
St. Joseph Lead, l, z, s	Various	1,950,508	10	3.00	5,851,335	3.00	5,851,375	.....	Dec., 1929	0.75
St. Mary's Mineral Land, c	Michigan	160,000	25	3.00	480,000	3.00	480,000	.....	Dec., 1929	1.00
Sidney Leasing, l, z, s	Idaho	7,215	1	2.00	10,823	3.00	21,645	72,150	Sept., 1929	1.00
Sidney Mining, s, l, z	Idaho	1,500,000	1	0.01	15,000	0.02	30,000	86,250	Oct., 1929	0.01
Silver King Coalition, l, s, z	Utah	1,220,467	5	1.10	1,342,514	1.30	1,586,607	24,330,698	Dec., 1929	0.45
*Sunshine Mining, s, l	Idaho	1,500,000	0.10	0.12	180,000	0.20	300,000	630,000	Dec., 1929	0.08
*Tennessee Copper & Chemical, c, su	Tenn.	794,626	No	0.75	595,970	1.00	794,626	4,288,841	Dec., 1929	0.25
Texas Gulf Sulphur	Texas	2,540,000	No	4.00	10,160,000	4.00	10,160,000	56,197,500	Dec., 1929	1.00
Tintic Standard Mining, l, s	Utah	1,153,315	1	1.40	1,614,631	1.30	1,499,330	12,456,585	Dec., 1929	0.20
Tonopah Mining, s, g	Nevada	1,000,000	1	0.15	150,000	0.15	150,000	16,875,000	Oct., 1929	0.075
United Gold Mines	Colorado	4,828,405	0.10	0.02	96,568	0.01	48,284	.....	Mar., 1929	0.01
U. S. Smelting, Ref. & Min.	Various	620,562j	50	3.50	1,228,903	3.50	1,848,701	61,842,486	Oct., 1929	0.875
U. S. Smelting, Ref. & Min., pfd.	Various	486,350	50	3.50	1,702,225	3.50	1,702,225	.....	Oct., 1929	0.875
*United Verde Extension, c	Arizona	1,050,000	0.50	2.00	2,100,000	3.75	3,937,500	36,592,500	Nov., 1929	1.00
*Utah-Apex, s, l, z, c	Utah	528,200	5	0.25	132,050	0.50	264,100	.....	Nov., 1929	0.25
Utah Copper	Utah	1,624,490	10	8.00	12,995,916	20.00	32,489,800	202,471,097	Dec., 1929	8.00
*Vanadium Corporation	Peru	376,638	No	4.00	1,506,548	3.00	1,129,906	.....	Nov., 1929	0.75
*Yankee Mines, c	Utah	876,300	0.10	.....	.....	0.02	17,526	.....	Feb., 1929	0.02
Mines Outside the United States										
Amparo Mining, s, g	Mexico	2,000,000	1	$0.04	$80,000	$0.04	$80,000	$2,532,177	Nov., 1929	0.01
Andes Copper	Chile	3,582,379k	No	0.75	2,320,352	2.25	8,049,364	10,369,716	Nov., 1929	0.75
*Aramayo Mines en Bolivie, t	Bolivia	1,008,000l	25 sw.fr.	2.5 fr.	2,100,000 fr.	5.00 fr.	4,620,000 fr.	9,882,177 fr.	April, 1929	2½ fr.
Asbestos Corporation, pfd	Quebec	14,561	100	$7.00	$521,927	$1.75	$130,482	.....	Jan., 1929	1.75
Balaghat Gold Mines	India	215,530	10s	6d	£5,313	6d	£5,313	£401,826	April, 1929	6d.
Balaghat Gold Mines, pfd	India	95,400	10s	1s 6d	£7,155	1s 6d	£7,155	.....	Sept., 1929	1s
†Boulder Perseverance, g	Australia	2,500,000	1s	1.2d	£12,500	1.2d	£12,500	.....	Jan., 1929	1.2
*Brakpan Mines, g	Transvaal	1,020,000	£1	9s 9d	£497,250	9s 9d	£497,250	.....	Dec., 1929	5s
*Broken Hill South, s, l, z	Australia	800,000	£1	4s 6d	£180,000	5s 6d	£220,000	.....	Nov., 1929	1s 6d
Burma Corp., s, l, z, c	Burma	13,541,689	10 Ru	1s 1½d	£761,720	1s 6d	£1,015,626	£4,894,756	Aug., 1929	10½d.
Cam & Motor Gold	Rhodesia	750,000	£1	6s	£225,000	4s	£150,000	£1,244,011	Aug., 1929	8d
†Camp Bird	Various	3,268,848	2s	4d	£45,480	.....	.....	.....	April, 1928	.....
†Camp Bird, pfd	Various	649,625	£1	1s 1.2d	£51,970	1s 7.2d	£51,970	.....	Dec., 1929	9.6d
*Cerro de Pasco Copper, c, l, s, g, z	Peru	1,122,842	No	$4.50	$5,052,789	$5.75	$6,456,342	.....	Nov., 1929	$1.50
*Chile Copper	Chile	4,415,497m	$25	$2.825	$11,590,681	$4.125	$18,213,905	$84,670,994	Dec., 1929	$2.375
*Con. African Selection, d	West Africa	999,111	5s	3s 6d	£174,644	3s 6d	£174,844	.....	.....	.....
Consolidated Main Reef, g	Transvaal	1,247,602	£1	2s 3d	£126,387	13s 9d	2s	£121,233	10s £2,157,701	.....
Cons. Mining & Smelting	Canada	509,750	$25	$12 50	$6,370,081	$12.50	$6,362,843	.....	July, 1929	.....
Crown Mines, g	Transvaal	1,880,212	10s	6s	£553,837 10d	6s 3d	£576,914	1s 3d £14,952,644	11s 3d	.....

Mining Dividends Paid in 1928 and 1929—Continued

Company, Metals Mined, and Class of Stock	Situation	Shares Outstanding	Par Value	1928 Per Share	1928 Total	1929 Per Share	1929 Total	Total Paid to End of 1929	Latest Dividend Paid to Dec. 31, 1929 Date	Per Share
†*De Beers, d	Transvaal	1,090,514	£2 10s	15s	£817,885	15s	£817,885	.....	.....	.....
†*De Beers, pfd	Transvaal	800,000	£2 10s	£1	£800,000	£1	£800,000	.....	.....	.....
Dome Mines, g	Ontario	953,334	No	$1	$953,334	$1	$953,334	$13,635,841.75	Oct., 1929	$0.25
Duthie Mines, s, l, z	British Columbia	1,534,075	$1	$0.05	$50,000	.....	.....	$50,000	Aug., 1928	$0.02
*El Oro Mining & Railway, s	Mexico	1,147,500	5s	.....	.....	1s 0.5d	£59,766	.....	Nov., 1929	1s 0.5d
†Electrolytic Zinc	Tasmania	1,100,000	£1	2s 4.8d	£132,000	2s 4.8d	£132,000	.....	Dec., 1929	1s 2.4d
†Electrolytic Zinc, pfd	Tasmania	1,500,000	£1	2s 4.8d	£180,000	2s 4.8d	£180,000	.....	Dec., 1929	1s 2.4d
*Erupcion Mining, l, s	Mexico	1,250,000	$1	$0.075	$93,750	.....	.....	$2,906,250	Jan., 1928	$0.075
*Frontino & Bolivia, g, s	Colombia	140,000	£1	1s 9d	£12,250	9d	£5,250	.....	Jan., 1929	9d
*Frontino & Bolivia, pfd	Colombia	23,390	£1	2s	£2,339	2s	£2,339	.....	July, 1929	1s
*Geduld Proprietary, g	Transvaal	1,328,052	£1	6s 9d	£446,217	6s 3d	£414,516	.....	Dec., 1929	3s 3d
Geldenhuis Deep, g	Transvaal	585,753	£1	6d	£14,166 14s	1s	£28,222 8s	£2,909,130 14s 9d	.....	.....
Globe & Phoenix Gold	Rhodesia	800,000	5s	3s	£120,000	2s 6d	£100,000	£3,896,358	June, 1929	1s
*Government G. M Areas, g	Transvaal	5,600,000	5s	4s 6d	£1,260,000	4s 6d	£1,260,000	.....	Dec., 1929	.....
*Granby Consolidated, c, s, g	B. C.	446,603	$100	$3.00	$1,339,809	$7.00	$3,126,221	.....	Nov., 1929	$2.00
*Greene Cananea, c, s, g	Mexico	500,000	$100	$2.00	$1,000,000	$7.50	$3,750,000	.....	Oct., 1929	$2.00
Hollinger Consolidated, g	Ontario	4,920,000	$5	$1.10	$5,412,000	$0.65	$3,198,000	.....	Dec., 1929	0.05
Howe Sound, c, s, l, s, g	Mexico, Can.	496,038	No	$4.00	$1,984,152	$4.50	$2,232,171	$9,474,324	Oct., 1929	$1.00
*International Nickel, n, c	Ontario	13,758,208m	No	$2.50	$4,183,460	$0.90	$12,382,387	.....	Dec., 1929	$0.25
*International Nickel, pfd	Ontario	89,126	$100	$6.00	$534,756	$7.00	$623,875	.....	Nov., 1929	.....
*International Nickel, pfd	Ontario	3,750,000o	$5	.....	.....	$0.35	1,312,500	.....	Nov., 1929	$0.0875
*Johannesburg Consolidated, g	Transvaal	3,950,000	£1	3s	£592,500	3s	£592,500	.....	Dec., 1929	1s 6d
Kamunting Tin Dredging	Malaya	1,500,000	5s	2s	£120,000	6d	£30,000	£545,883 10s	Jan., 1929	6d
*Keeley Silver	Ontario	2,000,000	$1	$0.04	$80,000	.....	.....	$2,240,000	Mar., 1928	$0.04
Lake Shore Mines, g	Ontario	2,000,000	$1	$1	$2,000,000	$1.10	$2,200,000	$8,220,000	Dec., 1929	$0.30
*Langlaagte Estate, g	Transvaal	1,519,833	£1	3s	£22,,975	3s	£227,975	.....	Dec., 1929	1s 6d
*Lucky Tiger-Combination, s, g	Mexico	715,337	10	$0.80	$579,423	$0.45	$341,891	$13,512,700	Dec., 1929	0.025
*Lydenburg Platinum	Transvaal	1,460,000	4s	.....	.....	3d	£18,250	.....	Dec., 1929	3d
McIntosh & Lee, s, l	B. C.	Closed co.	.....	.....	$56,000	.....	$56,000	$525,000	.....	.....
McIntyre Porcupine Mines, g	Ontario	798,000	$5	$1	$798,000	$1	$798,000	$8,399,408	Dec., 1929	$0.25
Messina (Transvaal) Development, c	Transvaal	1,000,000	5s	1s 6d	£70,286 10s	1s 10½d	£93,750	£406,789 19s 1d	July, 1929	1s
*Mexican Corporation, s, l, z, g, c	Mexico	1,000,000	10s	.....	.....	1s	£50,000	£50,000	Oct., 1929	1s
*Mining Corp. of Canada, s	Ontario	1,660,050	$5	$0.25	$415,012	$0.25	$415,012	.....	Dec., 1929	$0.125
Modderfontein B Gold Mines	Transvaal	2,800,000	5s	4s	£560,000	4s	£560,000	£9,537,500	.....	.....
*Modderfontein Deep, g	Transvaal	2,000,000	5s	6s 9d	£650,000	6s 9d	£650,000	.....	Dec., 1929	3s 6d
Modderfontein East, g	Transvaal	930,805	£1	2s 9d	£117,945 11s 3d	4s	£185,776	£303,721 11s 3d	.....	.....
Mount Lyell Mining, c, s, g	Tasmania	1,289,195	£1	2s 6d	£161,150	4s	£257,839	£5,006,400	Dec., 1929	2s 9d
*New Era Consolidated, g	Transvaal	800,000	5s	6d	£80,000	6d	£80,000	.....	Dec., 1929	3d
New Jagersfontein Mining, d	Transvaal	850,000	£1	4s	£170,000	4s	£170,000	£8,467,049 5s	Sept., 1929	2s
New Modderfontein Gold	Transvaal	2,800,000	10s	13s 6d	1,890,000	14s	1,960,000	£19,893,750	.....	.....
*New State Area, g	Transvaal	1,514,037	£1	2s 6d	£189,254	2s 6d	£189,254	.....	Dec., 1929	1s
New York & Honduras Rosario, s, g	Honduras	200,000	$10	$2.25	$450,000	$2.50	$500,000	$8,700,000	Dec., 1929	$1.00
Nipissing Mines, s	Ontario	1,200,000	$5	$0.30	$360,000	$0.30	$360,000	$29,400,000	Oct., 1929	$0.075
*North Broken Hill, s, l, s	Australia	700,000	£1	8s	£280,000	8s 9d	£332,500	.....	.....	.....
Nourse Mines, g	Transvaal	827,821	£1	1s	£39,183 4s	6d	£19,591 12s	£2,309,278	.....	.....
Nundydroog Mines, g	India	566,000	10s	1s 9d	£49,525	2s 3d	£63,675	£2,875,279	Oct., 1929	9d
†Oroville Dredging, g	Colombia	715,636	£1	1s 3d	£44,727	.....	.....	.....	Nov., 1928	1s 3d
Oruro, Minera de, t	Bolivia	300,000	20ch	4.50ch	1,350,000ch	2.50ch	750,000ch	21,600,000ch	May, 1929	2.50ch
*†Pahang Consolidated, t	Malay	1,500,000	5s	1s	£75,000	1s	£75,000	.....	.....	.....
*†Pahang Consolidated, pfd	Malay	100,000	£1	1s 4.8d	£7,000	1s 4.8d	£7,000	.....	.....	.....
*Patino Mines & Ent., t	Bolivia	1,045,100	$20	12s	£627,060	16s	£836,080	.....	Dec., 1929	4s
*Poderosa Mining, c	Chile	290,000	£1	.....	.....	1s	£11,600	.....	.....	.....
*Premier Gold, s, g	B. C.	5,000,000	$1	$0.28	$1,400,000	$0.24	$1,200,000	$13,550,000	Oct., 1929	$0.06
*Rand Selection, g	Transvaal	3,600,000	5s	1s 3d	£225,000	1s 3d	£225,000	.....	Dec., 1929	6d
Renong Tin Dredging	Malay	134,267	£1	.....	.....	3s 6d	£23,496 14s 6d‡	.....	Oct., 1929	2s
Renong Tin Dredging, pfd	Malay	25,000	£1	3s	£3,750	3s	£3,750	.....	June, 1929	3s 6d
†Rio Tinto, c, py	Spain	425,000p	£5	£2.10	£937,500	£3	£1,275,000	.....	Nov., 1929	£1 3s
†Rio Tinto, pfd	Spain	325,000	£5	5s	£81,250	5s	£81,250	.....	.....	.....
*Robinson Deept, g, "A"	Transvaal	500,000	1s	3s	£75,000	3s	£75,000	.....	Dec., 1929	1s 6d
Rose Deep, g	Transvaal	700,000	£1	1s	£33,149 3s	.....	.....	£4,500,686 16s 6d	.....	.....
St. John Del Rey Mining, g	Brazil	546,265	£1	2s	£54,626	2s	£54,626	£1,705,475	Dec., 1929	6d
St. John Del Rey Mining, pfd	Brazil	100,000	£1	2s	£10,000	2s	£10,000	.....	.....	.....
*San Francisco Mines, s, z, l	Mexico	1,503,959	10s	3s 9d	£283,243	4s	£300,792	£1,636,661	June, 1929	1s 6d
*Santa Gertrudis, s, g	Mexico	1,553,400	£1	3s	£233,010	3s	£233,010	£1,783,604	July, 1929	1s 6d
†South Kalgurli, g	Australia	300,000	10s	2s 6d	£35,000	1s	£15,000	.....	Jan., 1929	1s
*Springs Mines, g	Transvaal	1,500,000	£1	6s 9d	£506,250	7s 3d	£543,750	.....	Dec., 1929	3s 9d
*Sub Nigel, g	Transvaal	1,500,000	10s	6s	£450,000	4s	£300,000	.....	Dec., 1929	2s
†Sulphide Corporation, s, l, s	Australia	600,000	15s	.....	.....	1s 6d	£45,000	.....	Jan., 1929	1s6d
†Sulphide Corporation, pfd	Australia	600,000	£1	1s 6d	£45,000	2s	£60,000	.....	Jan., 1929	2s
Tanganyika Concessions, c	Various	5,473,606	£1	1s 6d	£407,704 10s	1s 6d	£407,704 10s	£1,299,081	July, 1929	1s 6d
Tanganyika Concessions, pfd	Various	26,394	£1	2s	£2,639 8d	2s	£2,639 8d	.....	July, 1929	2s
*Teck-Hughes Gold	Ontario	4,757,144	$1	$0.60	$2,860,286	$0.60	$2,860,286	$6,908,858	Nov., 1929	$0.15
*Tekka, Ltd., t	Nigeria	358,377	£1	1s 10.5d	£33,616	2s	£35,857	.....	.....	.....
Tharsis Sulphur & Copper	Spain	625,000	£2	3s 6d	£109,375	4s	£125,000	£11,307,260	.....	.....
*Van Ryn Deep, g	Transvaal	1,196,892	£1	8s	£478,756	7s	£418,912	.....	Dec., 1929	3s 6d
†Van Ryn Gold	Transvaal	500,000	£1	1s	£25,000	1s	£25,000	.....	.....	.....
Vieille-Montagne, z, l, s, "A"	Various	200,000q	80fr.	200fr.	35,000,000fr.	200fr.	40,000,000fr.	.....	.....	.....
Vielle-Montagne, z, l, s, "B"	Various	10,000	800fr.	25fr.	250,000fr.	50fr.	500,000fr.	.....	.....	.....
Village Deep, g	Transvaal	1,060,671	£1	.....	.....	1s	£50,005 13s	£2,324,782	.....	.....
*West Springs, g	Transvaal	1,793,000	£1	1s 9d	£156,888	2s	£179,300	.....	Dec., 1929	1s
*Witwatersrand Gold	Transvaal	469,625	£1	6d	£11,741	6d	£11,741	.....	Dec., 1929	6d
*Wright-Hargreaves, g	Ontario	5,500,000	No	$0.15	$825,000	.....	.....	$4,331,250	Nov., 1928	$0.025
†Zinc Corporation, l, s, s	Australia	658,616	10s	4s	£164,654	1s 6d	£49,396	.....	Jan., 1929	1s 6d
†Zinc Corporation, pfd	Australia	245,692	£1	8s	£93,277	5s 6d	£67,565	.....	Jan., 1929	5s 6d

†Indicates dividends paid during fiscal year instead of calendar year.

a As compared with 594,836 shares outstanding in 1928.

b Entire 7 per cent issue absorbed in 1928.

c Stock exchanged on the basis of three for one in 1929.

d As compared with 3,585,970 shares outstanding at the end of 1928. Company has absorbed stock of Chile Copper and most of Andes and Greene Cananea.

e Entirely absorbed, on a share for share basis, by U. S. Smelting, which see.

f Includes stock of New Cornelia Copper and old C. & A.

g Stock exchanged on the basis of two shares for one in 1929.

h Entirely absorbed by Calumet & Arizona and no dividends paid after first quarter of 1929.

i Exchanged on the basis of four shares for one in 1929.

j As compared with 350,115 shares outstanding in 1928.

k As compared with 3,093,803 shares outstanding in 1928.

l As compared with 840,000 shares outstanding in 1928.

m Virtually all stock absorbed by Anaconda Copper.

n As compared with 1,673,384 shares at end of 1928. Stock exchanged six for one, and Mond Nickel absorbed.

o Created to absorb preferred stock of Mond Nickel.

p As compared with 375,000 shares outstanding in 1928.

q Increased from 150,000 shares in mid-1928.

Letters after the company name indicate metal produced. These are omitted in cases where the company name includes the principal metal or metals produced, or where the company produces so many metals as to make listing unnecessary. C, copper; g, gold; d, diamonds; l, lead; n, nickel; t, tin; s, zinc; su, sulphur, py, pyrites. Ch stands for Chilean pesos.

In the column for total dividends paid to the end of 1929, totals are given for all classes of stock under the first class listed. Thus, the total of $41,708,249 for American Metal represents dividends on common stock, 6 per cent preferred stock, and the now defunct 7 per cent preferred stock.

ANNUAL REVIEW NUMBER

United States Commerce in Ores and Metals

From U. S. Government sources

Twelve-month periods ending with December
Figures in pounds, unless otherwise stated

I—Copper

	1928	1929
Imports		
Ore, concentrates, matte	148,304,755	180,452,292
Unrefined, black, blister	543,190,140	646,167,055
Refined	84,730,630	134,014,792
Old	10,632,507	13,598,166
Total	786,858,032	974,232,305
Exports		
Refined	949,474,456	822,452,824
Rods	71,325,075	81,087,829
Wire	15,675,751	16,868,636
Cable	19,651,105	25,080,448
Other forms, including scrap	65,060,253	47,404,282
Total	1,121,186,640	992,894,019

II—Lead

Imports		
In ore and matte	51,829,530	62,661,371
In bullion	256,935,461	166,141,916
In pigs, bars, and other forms	1,323,158	3,315,481
Type metal, lead content	3,086,770	4,849,979
Total	313,174,919	236,968,747
Exports		
In pigs and bars—		
From domestic ore	28,403,279	38,515,061
From foreign ore	201,161,444	106,006,202
Manufactures	14,907,264	13,176,213
Total	244,471,987	157,697,476

III—Zinc

Imports		
Ore (duty paid)	3,333,450	28,821,787
Ore (duty free)	20	1,696
Blocks and pigs	5,870	451,474
Total	3,339,340	29,274,957
Exports		
Ore, concentrates, and dross	6,300,586	6,980,284
Slabs, blocks, and pigs	50,513,472	28,015,947
Sheets, strips, and other forms	8,649,712	11,201,736
Zinc dust	2,016,497	2,511,381
Other zinc manufactures	2,025,798	1,244,016
Total	69,506,065	49,953,364

IV—Gold and Silver

Imports		
Gold, value	$168,897,307	$291,648,632
Silver, value	68,117,329	63,939,830
Exports		
Gold, value	$560,759,341	$116,582,923
Silver, value	87,382,016	83,407,197

V—Exports of Minor Metals and Minerals

Aluminum: Ingots, scrap	2,390,498	613,366
Manufactures	14,341,740	18,885,259
Nickel, metal and alloys	2,349,269	2,869,686
Platinum, oz	11,218	4,022
Tin bars	781,072	1,768,891
Tin manufactures, value	$1,514,240	$1,870,717
Asphalt and bitumen, tons	23,449	41,930
Manufactures of, lb	39,044,233	61,835,301
Sand and gravel, tons	658,364	434,265
Cement, bbl	824,656	885,321
Fireclay, tons	53,695	68,358
Other clays, tons	54,385	68,562
Asbestos, tons	759	633
Asbestos manufactures	8,201,925	10,568,926
Gypsum and manufactures	48,064,040	67,637,412
Mica and manufactures	3,661,587	6,187,270
Sulphur, tons	685,051	855,542
Salt	290,792,498	218,443,167
Graphite and manufactures, except crucibles	4,406,031	3,226,857
Phosphate, high-grade hard rock, tons	89,702	67,474
Sand pebble and other phosphate rock, tons	809,062	1,075,272
Borax	135,702,837	159,767,825
Ocher, umber, sienna, whiting	38,733,021	41,959,784
Magnesia and manufactures	5,857,319	6,259,317

VI—Imports of Minor Metals and Ores

Aluminum, metal, scrap and alloy	37,895,832	48,370,921
Antimony in ore	4,369,148	3,729,180
Metal	22,697,566	26,859,614
Cobalt	643,315	1,241,083
Platinum, oz	108,447	115,221
Iridium, oz	4,212	4,470
Osmium and osmiridium, oz	6,095	7,977
Palladium, oz	13,463	24,364
Rhodium and ruthenium, oz	2,977	3,031
Quicksilver	1,168,748	1,086,221
Nickel: Ore and matte	18,589,032	28,981,343
In pigs, ingots, and other forms	48,995,620	64,420,873
Manganese ore, tons	207,808	323,415
Chrome ore, tons	216,592	345,990
Tin, bars, blocks, pigs	174,653,760	195,165,173
Tungsten	2,729,508	6,809,965
Ferrochromium, chromium metal, and chrome-vanadium	1,605,215	1,494,777
Ferrosilicon (silicon content)	9,983,191	21,110,090

VII—Imports of Non-Metallic Minerals

Bauxite, tons	350,111	380,812
Marble, cu.ft	590,511	727,052
Sand and gravel, tons	673,860	1,507,487
Lime and limestone	54,054,913	65,695,646
Kaolin, china and paper clay, tons	274,472	249,921
Other clays, n.e.s., tons	53,906	62,419
Corundum, tons	1,400	3,378
Emery, tons	4,846	5,717
Flint, tons	14,035	12,542
Asbestos, unmanufactured, tons	205,888	234,309
Asbestos, manufactured	56,370,824	57,214,476
Cryolite, tons	6,906	7,778
Chalk, crude, tons	96,856	102,563
Fluorspar, tons	42,128	48,522
Gypsum, crude, tons	918,586	925,344
Mica, crude	502,516	1,317,406
Mica, cut, split	3,187,934	5,691,731
Diamonds, rough, carats	291,302	354,415
Cut, unset, carats	440,437	416,992
Pyrites, tons	458,264	514,336
Talcum, steatite, French chalk	54,015,900	62,493,839
Magnesite	127,002,935	106,364,569
Salt	84,048,905	91,675,331
Graphite	35,685,664	47,922,028
Mineral wax	10,901,389	9,791,090
Iodine, crude	720,766	627,162
Nitrate, sodium, tons	9,674	12,800
Ochers and sienna	21,499,263	22,033,745
Lithopone and other zinc pigments	22,681,026	19,578,476
Potash, crude chloride, tons	233,611	230,966
Crude sulphate, tons	86,458	79,510
Kainite, tons	107,051	75,930
Manure salts, tons	404, 680	390,828

VIII—Iron Ore and Pig Iron

Exports		
Iron ore, tons	1,282,306	1,304,417
Pig iron, tons	84,682	46,357
Imports		
Iron ore, tons	2,452,646	3,139,334
Pig iron, tons	140,694	147,763

Important Mining Securities in 1929*

Company	Exch.	High		Low		Last	Net Change	Sales
COPPER								
Anaconda Cop...	N. Y.	140	Mh. 22	67½	De. 23	75½	—44⅜	18,545,825
Andes Copper....	N. Y.	68⅜	Mh. 1	30	Oc. 29	33⅜	—19⅛	4,803,700
Arizona Com...	B.	5½	Ja.	1¼	Se.	1½	—3½	11,818
Bwana M'Kubwa	N. C.	8	Se. 12	4	No. 13	5½	.....	143,700
California Cop...	S. F.	10⅛	Fe.	2	No.	2	—6½	134,783
Calumet & Ariz..	N. Y.	136½	Au. 7	73½	No. 14	83½	—39½	401,675
Calumet & Hecla	N. Y.	61½	Mh. 1	25	Oc. 29	29⅛	—17⅜	2,506,800
Cerro de Pasco.	N. Y.	120	Mh. 1	52¼	No. 13	63⅜	—47⅛	1,471,900
Chile Copper...	N. Y.	127⅛	Mh. 21	53	No. 14	60	—13⅜	1,407,100
Con. Copperms.	N. C.	18	Mh. 18	4	Oc. 29	5¼	—8½	775,900
Copper Range..	B.	33	Mh.	14	De.	15	—12	176,219
East Butte.....	B.	5	Mh.	1½	Se.	1½	—2½	122,004
Granby.....	N. Y.	102⅞	Mh. 20	46½	No. 14	53	—37	1,807,900
Greene Cananea	N. Y.	200½	Se. 7	106	No. 14	112	—61½	1,921,900
Howe Sound....	N. Y.	82½	Mh. 21	34⅜	No. 26	37⅜	—30½	1,104,100
Hudson Bay....	N. C.	23	Fe. 6	6	Oc. 24	8⅜	—12½	1,291,500
Inspiration.....	N. Y.	66⅜	Mh. 1	22	Oc. 24	26⅜	—20½	1,746,100
Iron Cap.....	N. C.	9⅜	Mh. 12	1	Oc. 29	2⅜	—1⅛	153,600
Isle Royale.....	B.	35	Mh.	10	De.	12	—14½	109,042
Kennecott.....	N. Y.	104⅛	Mh. 18	49⅛	No. 13	58⅛	—19½	11,484,600
Magma Copper.	N. Y.	82½	Mh. 21	35	No. 13	46	—24	749,600
Mason Valley...	N. C.	2⅛	Ja. 3	1⅛	My.	2	0	234,500
Miami Copper..	N. Y.	54⅛	Mh. 20	20	Oc. 29	28	—4⅛	1,819,800
Mohawk.....	B.	64⅛	Se.	41	Ja.	43½	—1⅛	81,536
Mother Lode....	N. Y.	6½	Mh. 4	1½	Oc. 29	1½	—1½	1,172,700
Nevada Con....	N. Y.	62⅛	Mh. 18	23½	No. 13	29⅛	—13	6,649,900
New Cornelia...	N. C.	48⅛	Ap.	40	Ja.	45⅜	+3½	266,000
Noranda.....	N. C.	68⅛	Ja. 23	10	Oc.	34½	—29⅛	1,531,600
North Butte....	B.	8⅛	Mh.	2½	De.	3	—3⅛	849,918
Ohio Copper....	N. C.	4⅛	Ja. 21	⅜	Oc. 24	1½	—⅛	3,152,300
Old Dominion...	B.	19⅛	Mh.	5½	No.	6½	—12⅛	83,163
Phelps Dodge...	N. Y.	79⅛	My. 10	31	No. 13	38⅛	.....	421,900
Phelps D. old...	N. C.	375	Fe.	199½	Ja.	302	+107	52,735
Quincy.....	B.	51	Fe.	16½	No.	18	—29½	247,038
Roan Antelope..	N. C.	52	Je. 12	22½	No. 13	27½	—10½	333,800
St. Mary's M. L.	B.	46	Mh.	22	No.	25½	—10½	83,034
Seneca Copper...	N. Y.	10½	Mh. 20	2	No. 13	2½	—3	818,600
Shattuck Denn..	N. C.	28	Fe. 25	3	Oc. 29	8½	—13⅛	442,500
Sherritt-Gor.....	T.	9.90	Mh.	2.50	De.	3.14	—3.36	5,801,865
Tennessee Cop..	N. Y.	20⅛	Ap. 29	9⅛	No. 13	13	—6	1,119,500
United Verde Ex.	N. C.	26	Mh. 20	11⅛	No. 13	12½	—11⅛	655,500
Utah Copper....	N. Y.	353	Mh. 19	224½	No. 25	240	—33	1,260
Waite-Ack-Mont.	T.	8.30	Au.	1.50	Mh.	3.25	+0.50	229,750
Walker.....	S. L.	6.40	Au.	2.40	Ja.	4.35	+1.90	187,058
Wenden.....	N. C.	2½	Ja. 26	⅛	Oc.	¼	—1	522,600
LEAD-ZINC-SILVER								
Ahumada Lead..	N. Y.	4¼	Fe. 20	⅛	De. 26	⅜	— 3	669,100
Amer. Z. L. & S.	N. Y.	49½	Mh. 18	7	No. 13	9	—33½	744,250
A Z. L. & S. pfd.	N. Y.	111½	Mh. 19	49⅜	No. 13	55½	—49½	92,506
Bunker Hill & S.	N. C.	165	Mh. 22	98	De. 28	98½	—29½	13,300
Butte Cop. & Z..	N. Y.	9⅛	Ja. 3	2	Oc. 30	3½	—5½	416,800
Butte Cop. Con.	B. C.	1⅛	Ja.	.25	Au.	.31¼	—75	.....
Butte & Super..	N. Y.	12⅛	Ja. 4	4⅛	De. 24	5	—5⅛	163,900
Callahan Z-L...	N. Y.	4	Ja. 22	1	Oc. 29	1	—2½	287,700
Canam Metals...	T.	1⅛	Au.	.60	De.	.60	.....	634,635
Chief Consol....	S. L.	4.10	Ja.	1.80	De.	1.825	—1.875	114,715
Con. Lead & Z..	St. L.	17½	My.	5	De.	5⅜	—6⅜	58,575
Constitution....	S.	.69	Jy.	.33½	My.	.33½	—4½	32,600
Dayrock.....	S.	4	Oc.	2	De.	2	.....	4,350
Dickens Consol.	S.	.26½	Fe.	.02½	De.	.03½	.....	2,437,567
Eagle-Picher....	C.	21	Ja.	11⅛	Oc.	13	—7⅛	120,192
Eagle-P. pfd....	C.	103	Au.	101	Oc.	101	—9	83
Erupcion.....	B. C.	.29	Ja.	.10	My.	.12	—13	.....
Eureka Bullion..	S. L.	1.25	Au.	.36	De.	.42½	.....	603,790
Eureka Lilly....	S. L.	2.27½	.....	.80	.....	1.20	—0.10	286,419
Evans-Wallower	N. C.	26⅜	Fe. 6	3½	De. 20	5⅛	—9⅛	453,000
Evans-Wal. pfd.	N. C.	94	Mh. 5	70	Jy. 16	86	+5⅜	2,400
Federal M. & S..	N. Y.	310	Fe. 4	170	De. 18	175	—45⅛	10,550
Fed. M. & S. pfd.	N. Y.	102	Jy. 5	95	Oc. 29	96⅛	—4⅛	8,700
Gladstone.....	S.	.15½	Fe.	.01	No.	.01	—3½	85,000
Golconda.....	S.	1.87	My.	.66	Se.	.81	+2	1,133,728
Grandview.....	S.	.89	Ja.	.11½	De.	.15½	.....	1,233,913
Hecla Mining...	N. C.	23⅜	Mh.	10	Oc.	12⅜	—4⅛	124,900
Highl'd-Surprise	S.	.17½	Ja.	.06½	De.	.07⅜	—5⅛	94,199
Iron King.....	S. L.	.94	.....	.40	.....	.40	.....	129,851
Jack Waite.....	S.	.22½	Fe.	.06½	De.	.07½	.....	1,449,500
Keystone.....	S. L.	.50	.....	.33	.....	.33	+3	51,420
Kootenay Flor'e.	S.	.28	Ja.	.06½	De.	.06½	.....	278,150
Lucky Jim.....	S.	.26	Ja.	.07½	De.	.07½	—12½	33,100
Lucky Tiger C..	K. C.	6.50	Ja. 2	1.25	De. 20	1.25	—5.25	50,800
Mammoth.....	S. L.	1.80	.....	.90	.....	1.05	+0.20	15,908
Mexican Premier	S.	2.48	Au.	.82	Ja.	2.02	.....	429,868
National Lead..	N. Y.	210	Oc. 15	129½	No. 12	134½	+4	267,400
Nat. Ld. pfd. A.	N. Y.	141⅛	Fe. 1	138	No. 15	138½	—1⅛	14,020
Nat. Ld. pfd. B.	N. Y.	122	Fe. 27	116	Au. 5	117	—1½	7,470
New Jersey Zinc	N. C.	87⅞	Se. 19	60½	No. 13	66	—7	3,900
New Quincy....	S. L.	3.30	.....	.70	.....	1.20	+0.36	917,824
Noble Five.....	S.	.62½	Au.	.38	De.	.38	.....	4,300
North Lily.....	S. L.	10	Mh.	2	De.	2.32½	—5.62½	137,105
Park Pingham..	S. L.	.15	Ja.	.04½	De.	.05⅜	—4½	752,833
Park City Con..	S. L.	2.30	.....	.70	.....	.70	.....	15,175
Park Utah.....	N. Y.	13⅞	Fe. 28	3	De. 23	3½	—8½	1,663,600
Pend Oreille....	S.	6.50	Au.	2.65	De.	2.65	.....	1,700
Rico-Argentine..	S. L.	.50	Mh.	.15	De.	.16½	—30½	228,081
St. Joseph Lead.	N. Y.	94	Ja. 21	38½	No. 13	48½	—20½	2,658,000
Sherman Lead..	S.	.90	Oc.	.33	Jy.	.74½	+53	79,200
Silver King C...	S. L.	16	Mh.	9½	De.	10⅛	—2½	47,822
Silversmith.....	S.	.18	Fe.	.05½	De.	.06	—2	334,400
Sunshine Mng..	S.	7.09	Oc.	1.85	My.	4.75	+3.45	43,535
Tamarack-Cust.	S.	1	Jy.	.34	Ja.	.54	+19	289,732
Tintic Standard.	S. L.	15⅛	Mh.	10½	De.	10½	—3½	101,334
Tonopah Belmt.	N. C.	2	Ja. 2	⅜	No. 11	⅜	—⅛	23,000
Treadwell-Yuk..	T.	18½	Fe.	5½	No.	7	—3	70,467
United Zinc Sm.	N. C.	8⅛	Oc.	7½	Oc.	7½	.....	700
Utah Apex.....	B.	6⅜	Mh.	2¼	Oc.	2¼	—1½	125,126
Utah Met.&Tun.	B.	2¼	Mh.	.50	Oc.	.65	—50	221,767
Whitewater.....	S.	.75	My.	.19	De.	.56	.....	3,100
Yellow Pine....	L. A.	.25	Fe.	.05	Fe.	.08	—33	46,200
GOLD AND SILVER								
Alaska Juneau..	N. Y.	10½	Ja. 8	4½	No. 13	8	—½	1,301,400
Barry-Hollinger.	T.	.44	Ja.	.13½	De.	.17	—14½	3,053,364
Carnegie Metals	N. C.	21½	Je. 27	4½	De. 30	5½	—14½	73,600
Castle-Tre'wey..	T.	.40	Ja.	.22	De.	.25	—13	548,899
Cen. American..	P.	5½	.....	2	.....	.....	.....	.....
Cen. Manitoba..	T.	.80	Ja.	.19½	De.	.23	—40	1,483,000
Coniagas.....	T.	2½	Ja.	.90	Oc.	1½	—⅜	63,644
Coniaurum.....	T.	2½	Ja.	.25	Mh.	.35	—90	44,716
Consol. Cortes...	N. C.	.37	Fe. 1	.06½	Au. 15	.08	—12	82,700
Cresson Consol..	N. C.	1⅛	Ja. 17	.25	De. 28	.25	—46	236,000
Dolores Espsa..	N. C.	1⅛	Mh. 2	1/16	Oc. 23	1/16	—1⅛	77,100
Dome.....	N. Y.	11⅛	Au. 1	6	No. 14	6½	—2½	354,500
Golden Cycle C.	C. S.	17.80	Se. 12	14½	De. 31	14½	.....	2,287
Golden C.M.&R.	C. S.	1.95	Je. 20	1.51	Ja. 10	1.77	.....	143,075
Hollinger.....	T.	10	Ja.	4	Oc.	5.05	—3.45	434,641
Homestake.....	N. Y.	93	Au. 22	65	No. 12	80	5	25,100
Keeley.....	T.	.65	Ap.	.30	De.	.33	—6	527,677
Kerr Lake.....	N. C.	1⅛	Ja. 26	1/16	De.	1/16	—1/16	37,100
Kirkland Lake...	T.	1.92	Ja.	.39½	De.	.54	—1.11	2,161,970
Lake Shore.....	T.	27.60	Ap.	13	Oc.	19.30	—0.70	520,863
McInt re Porc..	N. Y.	23½	Ja. 5	12½	No. 4	15	—6	31,300
Mining Corp....	T.	6.05	Mh.	2.65	Oc.	2.95	—1	1,539,285
Montana Idaho.	S.	15½	.....	4⅛	.....	.....	.....	.....
Montana Mines.	S.	.51	Oc.	.30	De.	.47½	.....	279,634
Natomas.....	S. F.	30	Ap.	22	My.	23⅛	.....	8,566
N. Y. & Hond.R.	N. C.	18	Ap. 11	10½	No. 15	16	—⅛	6,900
Nipissing.....	N. C.	3⅛	Ja. 2	1⅛	De.	1⅛	—2	121,100
Portland.....	C. S.	.12	My. 4	.04½	Se. 23	.05	—4	208,900
Premier Gold...	N. C.	2⅛	Ja.	1⅛	No. 14	1⅛	—⅛	181,400
Rand Mines.....	N. Y.	36½	Fe. 11	25	No. 7	25	—12½	4,780
Siscoe.....	T.	1.60	Ja.	.32	De.	.43	—52	7,237,941
Sylvanite.....	T.	2.60	Ja.	.40	No.	.41	—1.69	354,405
Teck-Hughes....	T.	10.25	Fe.	4.75	Oc.	5.05	—3.85	3,186,001
Tom Reed.....	L. A.	.75	Au.	.05	Fe.	.52	+26	292,496
Tonopah Ext...	N. C.	.39	Ja.	.08	Ja.	.10	+4	240,600
Tonopah Mng...	N. C.	4⅛	Ja. 23	2	No. 7	2½	—1⅛	20,500
United Eastern..	N. C.	1⅛	Fe. 28	⅛	No. 14	1/16	—⅛	71,100
United Gold....	C. S.	.16½	Fe. 27	.10	No. 1	.10⅛	—5⅛	123,499
Unity Gold.....	N. C.	2⅛	Ap. 18	⅛	No. 13	1/16	—1⅛	215,500
Vipond Cons.....	T.	1.25	Ja.	.55	Oc.	.66	—16	2,923,552
Wright-Hargr...	T.	2.95	Ja.	1.15	Je.	1.35	—0.90	4,223,307
Yukon-Alaska...	N. C.	35⅛	Fe. 27	33	Fe. 13	35⅛	+4⅛	2,800
Yukon Gold....	N. C.	1⅛	Ja. 2	⅛	De. 15	1/16	—⅛	85,600
IRON AND STEEL								
Bethlehem Steel	N. Y.	140⅜	Au. 24	78⅛	No. 13	94⅜	+7⅛	13,177,120
Beth Steel pfd..	N. Y.	128	Se. 18	116⅛	My. 31	123	—1	148,250
Cleveland-Cliffs.	Cl.	157½	Oc.	115	De.	.....	.....	.....
Colo. Fuel & Iron	N. Y.	78⅛	Mh. 3	27⅛	No. 14	36⅛	—33⅛	1,056,100
Colo. F. & I. pfd.	N. Y.	137⅛	Se. 19	126	Oc. 11	126	—4	420
Gt. Northn. Iron	N. Y.	39½	Fe. 1	19	Oc. 24	20	—9⅛	1,860,300
Inland Steel....	N. Y.	113	Au. 26	71	De. 23	73	—6	380,100
Republic I. & S.	N. Y.	146½	Se. 20	62½	No. 13	76½	—9⅛	2,975,300
Rep. I & S. pfd.	N. Y.	115⅛	Fe. 27	103⅛	No. 14	107⅛	—1⅛	18,600
Sloss-Sheffield...	N. Y.	125	Ja. 19	21	No. 15	35	—88	42,950
Sloss-Shef. pfd..	N. Y.	112	Ja. 18	62½	No. 14	73½	—32⅛	11,700
U. S. Steel.....	N. Y.	261⅛	Se. 3	150	No. 13	171	+19⅛	20,336,700
U. S. Steel pfd...	N. Y.	144½	Mh. 1	137	No. 14	141⅛	+⅛	269,700
Virginia I.C.&C.	N. Y.	25⅛	My. 16	13	De. 23	13	—12	3,060
Va. I.C. & C. pfd.	N. Y.	48	Ja. 29	39	De. 18	39	—9⅛	2,660
MISCELLANEOUS								
Alum'm Co. Am.	N. C.	539⅛	Au. 5	146	Ja. 7	290	+139	108,500
Aluminum pfd..	N. C.	110	Je. 5	103	No. 13	108⅛	+4⅛	40,600
American Metal	N. Y.	81⅛	Fe. 6	31⅛	No. 13	46⅛	—15⅛	1,658,700
Amer. Met. pfd..	N. Y.	135	Fe. 6	106	No. 13	113	—4	33,300
Amer. Smg. & R.	N. Y.	130⅛	Se. 5	62	No. 13	72⅛	—24⅛	4,184,750
A. S. & R. pfd..	N. Y.	138	Ja. 4	123⅛	No. 15	135	—1	47,100
A. C. Nitrate...	N. C.	45⅛	Ja. 21	15	Oc. 30	18⅛	—14⅛	204,900
Asbestos Corp..	M.	22⅛	Ja.	2	De.	2⅛	—14⅛	49,348
Asbestos pfd....	M.	69	Ja.	10	No.	12	—53	14,510
Con. Mng. & S..	M.	575	Fe.	210	Oc.	250	—149	69,257
DeBeers Consol.	N. Y.	25	Mh. 10	14	De. 26	14	—7	990
Feder'ed Metals	N. C.	38⅛	Mh. 8	20	No. 14	23⅛	—11⅛	16,750
Freeport Texas..	N. Y.	54⅛	Ja. 25	23⅛	No. 13	39⅛	—9⅛	1,012,700
Int. Nickel.....	N. Y.	72⅛	Ja. 23	25	No. 13	32⅛	—13⅛	17,352,700
Int. Nickel pfd..	N. Y.	128	Mh. 15	112	No. 13	118	—⅛	5,900
Mayflower Asso.	N. C.	101⅛	Se. 26	46⅛	No. 19	51	.....	138,700
Met. & Min. Shs.	N. C.	23⅛	My. 28	5	Oc. 30	9⅛	.....	694,700
Newmont.....	N. C.	236	Se. 12	89	No. 13	108	—95	617,400
Patino M. & E..	N. Y.	47⅛	Mh. 4	24⅛	Oc. 29	28⅛	—8⅛	1,340,900
S. Amer. G. & P.	N. C.	3⅛	Fe. 25	1⅛	No. 13	1⅛	—1⅛	67,800
Texas Gulf Sul..	N. Y.	85⅛	Ap. 18	42⅛	No. 13	54⅛	—24⅛	4,041,850
U. S. S. R. & M.	N. Y.	72⅛	Mh. 20	29⅛	Oc. 29	34⅛	—30	939,200
U. S. S. pfd.....	N. Y.	58	Ja. 3	48	Oc. 30	52	—5	33,900
Vanadium Corp.	N. Y.	116⅛	Jy. 8	32⅛	No. 13	50⅛	—51⅛	1,908,900
Ventures, Ltd...	T.	14.85	Mh.	2.25	.....	3	.....	860,806

*Compiled by *Engineering and Mining Journal.*

N. Y., New York Stock Exchange; N. C., New York Curb Market; B, Boston Stock Exchange; B. C., Boston Curb; S. F., San Francisco; T, Standard Stock and Mining Exchange, Toronto; S. L., Salt Lake City; St. L., St. Louis; S, Standard Stock Exchange, Spokane; C, Cincinnati; K. C., Kansas City; L. A., Los Angeles; P., New York Produce Exchange; C. S., Colorado Springs; Cl., Cleveland; M., Montreal.

NEWS OF THE INDUSTRY

St. John del Rey Increasing Reserves at Morro Velho

Complete reorganization of the mining methods at the Morro Velho mine of St. John del Rey has put the mine in splendid order, according to A. G. N. Chalmers, general manager of the company. An increase in the amount of development work done has added considerably to ore reserves, and tonnages comparable to those mined when the property was 2,000 ft. shallower are being extracted. At present the mine is bottomed at 7,333 ft., exceeded only by the Village Deep, on the Rand. A new safety and ventilation shaft has been recently completed at the property. The improved ventilation and the addition of the men engaged in this work to the normal stoping and development forces have aided in increasing the ore reserves. Production is now averaging £45,000 of gold a month, as compared with a total output of £415,000 in 1928.

■

Zinc Corp. Closes Acid Unit

At the end of December, the Zinc Corporation closed the zinc roasting and sulphuric acid unit at its property, in the Broken Hill district, New South Wales, Australia. The plant employed about twenty men. This change has been effected because sulphuric acid has been displaced by sodium carbonate in flotation treatment of the company's lead-zinc ore. The company is milling about 800 tons of ore daily at present, and production is averaging 5,000 tons of lead concentrate and 4,500 tons of zinc concentrate a month. Grade of the lead concentrate was 69 per cent lead during November, which is well above the average grade of Broken Hill concentrate.

■

Airplanes to Aid Utah Mining

Articles of incorporation for the Aërophoto Corporation, formed by Salt Lake City mining men, have been filed. The company will engage in aërial photography, exploration, transportation, and making of geological maps to aid mine development and research, according to S. F. Robertson, president of the company. Other officers include R. A. Brown, N. A. Robertson, C. T. Van Winkle, and G. W. Snyder.

■

Sylvia Lake Mill Started

First shipments of concentrate have been made from the new 500-ton zinc concentrator of St. Joseph Lead at its Sylvia Lake property, Balmat, N. Y. Construction of the plant was started only about seven months ago. A model village of 50 houses has also been erected at Balmat.

Copper Mines Finding Work for Men Laid Off in Curtailment Programs

TO RELIEVE unemployment conditions in the copper-mining districts where operations have been curtailed to prevent accumulation of large stocks of the metal, several of the important copper companies are offering part-time work, or are increasing the amount of construction and development under way. For the purpose of dividing available work among the employees of Anaconda Copper, at Butte, mining operations are being carried on through a system of rotating regular employees. This step was taken on Jan. 17, when the company closed its Anaconda and Original mines. The Leonard mine had been closed shortly before. The system of rotating will give every regular employee at least two-thirds time.

A similar step is being taken by Utah Copper, at Bingham, Utah, according to D. D. Moffat, assistant general manager of the company. From 300 to 400 men who were dismissed have been re-employed by the company, and, although full-time employment cannot be accorded, the men will be provided with sufficient earning power for every-day needs.

United Verde Copper, at Jerome, Ariz., which closed down one of its reverberatory furnaces, necessitating the reduction of its smelter force by 150 men, has transferred this force to construction work on its flotation concentrator, capacity of which is being increased from 1,500 to 2,000 tons daily. An electrolytic zinc test plant is also being built by the company to make extensive experiments on results obtained in research work. A large number of men are employed in underground development, the most important feature of which at present is sinking of No. 7 shaft.

Phelps Dodge is curtailing its output by adopting the five-day week at its mines in Arizona and Mexico, effective Feb. 9.

Nevada Consolidated has laid off about 300 men at its properties in the Ely district, and the ore produced from its own mines has been reduced to 7,500 tons daily. In addition, 3,000 tons of ore from Consolidated Coppermines is being treated under contract. Concentrator capacity is 18,000 tons daily, so that the Nevada operations are really on a 50 per cent basis.

A cable report to the U. S. Department of Commerce from Santiago states that copper production by the largest producers in Chile—the United States controlled Chile, Braden, and Andes properties—is about 50 per cent of capacity, with reduction in labor employed being slowly effected.

■ ■ ■

High Grade in Sherman Raise

High-grade ore has been struck in a raise that is being put up from the 1,000 level of the Sherman Lead property, in the Coeur d'Alene district, Idaho. The strike was made about 640 ft. above the 1,000 level and about 200 ft. from the surface. It carries a high silver-lead assay, with practically no zinc, and occurs both in carbonate and sulphide form. The orebody is 8 ft. wide, of which half is smelting ore and the other half milling ore. Sherman Lead is controlled by the Day interests and ships ore to the Hercules mill, near Wallace.

■

Boleo Averts Labor Strike

The threatened strike of miners at the Boleo Copper property, Lower California, Mexico, on Jan. 6 did not materialize. The management alleges that it gave an increase of 90c. per day to the miners several months ago and that present conditions do not justify another increase. Danger of a strike is now considered remote, as many of the men let out by the suspension of the La Dura operations, in Sonora, have emigrated to Lower California in the hope of obtaining employment. The Boleo management has issued a statement that the camp is overcrowded with men and that further migrations to that point would be futile.

■

Golconda Hoisting in New Shaft

Hoisting through the new three-compartment shaft at the Golconda Lead property, in the Coeur d'Alene district, Idaho, was started about Feb. 1 after it had been raised through from the 1,400 to the 1,000 level. Sinking to the 2,000 level has now been started. As the collar of the shaft is about 1,000 ft. nearer the concentrator than the old shaft, its use will double the potential effective capacity of the mine, which has been producing 200 tons of lead-zinc ore daily.

Golconda has a cash surplus of $128,000, according to W. A. Beaudry, managing director of the company, in spite of low metal prices, payment of two dividends, and the cost of the new construction and development work. By next December the management expects to have placed the operation on the basis of 400 tons daily.

Falconbridge Nickel Starts New Smelter at Sudbury

Sudbury, Ont., Feb. 5.—The initial unit of the new smelter at Falconbridge Nickel Mines, at Falconbridge, was successfully blown in on Monday, Feb. 3, and production of matte was started today. The unit consists of one blast furnace and two converters, with a capacity of 250 tons of charge daily. The hoisting and crushing equipment at the mine have been in operation for several days, filling the bins in preparation for the smelter start. The tonnage hoisted is about 300 tons of ore daily. Average grade is about 3 per cent nickel and 1 per cent copper. After hand separation, about 200 tons will be sent through the smelter. Although the capacity of the present equipment is only 250 tons daily, the plant can be stepped up to 500 tons as soon as sufficient market demand for the product can be created. The recently acquired nickel refinery in Norway has been operating on Norwegian matte for the last two or three months.

Diamond drilling from the 1,000 level at Falconbridge has struck the downward continuation of the orebody at a depth, vertically, of 1,750 ft. The hole passed through 24 ft. of mineralized material at this depth. About 50 per cent of the material in the core is classed as junore and the remainder as ore. A previous hole struck ore at 1,500 ft. and cut 40 ft. of mineralization. Lateral development of the mine has been undertaken to a depth of 1,000 ft. and has proved the existence of 1,367,000 tons of ore above that level.

The Falconbridge enterprise is the first Sudbury nickel property to enter the producing stage since the ill-fated British America Nickel Corporation, a war baby, was unsuccessfully launched on the Murray mine property in 1919. Falconbridge is controlled by the so-called Lindsley interests, which acquired the mine late in 1928. It had previously been owned by the E. J. Longyear Company. Since taking over the mine, a new shaft has been sunk to 1,000 ft., a town has been built, and the smelter has been erected and put in operation. A cable tramway connects the mine surface plant with the smelter.

■

Humboldt Smelter Started

Southwest Metals started its remodeled copper smelter at Humboldt, Ariz., on Feb. 4. Telegraphed reports to New York City state that the plant is running smoothly. For the present it will handle about 125 tons of charge daily, but as high as 250 tons can be smelted in the reverberatory furnace. Ore and concentrate will be supplied by the company's De Soto mine; the Sheldon mine, near Walker, controlled by the same interests, which is shipping a carload of concentrate daily; and custom shippers.

■

P. D. to Drill Sacramento Area

Drilling to ascertain whether the orebodies extend laterally or vertically from the present known boundaries is being undertaken on Sacramento Mountain by the Cooper Queen branch of Phelps Dodge at Bisbee, Ariz. A new haulage level is being prepared at 1,200 ft. for handling ore from the southeast orebody in this area. Caving will be undertaken on a block of ore between the 400 and 500 levels in the east orebody section.

Development work from the Warren shaft has struck no ore yet, in spite of published reports to the contrary. Mineralization has been found at one or two points.

■

Frood Output From Development Near 2,000 Tons Daily

Shipments of ore from development work on the lower levels of the Frood mine of International Nickel, in the Sudbury district, Ontario, are now close to 2,000 tons of ore daily. Shipments are said to be averaging about 12 to 15 per cent copper and about 2 per cent nickel. Development work is averaging more than a mile of new workings monthly. About 2,000 men are employed and 250 drilling machines are in operation. Raises have been started preparatory to stoping above the 2,800 level. The mine is expected to be fully developed and ready for large-scale production about July or August.

■

Kildun Mining Sinks Shaft

Kildun Mining is sinking the main shaft at its property near Matehuala, San Luis Potosi, Mexico, to 450 m. At present the deepest level in the mine is at 300 m. Development has shown silver ore assaying 16 oz. to the ton over widths averaging 3 m. On the 150-m. level, the orebody has been proved for a length of about 250 m.; on the 200-m. level, for about 320 m.; and on the 300-m. level, where work has been under way for only a short time, for about 60 m. The company has just completed installation of two new 260-hp. Ingersoll-Rand Diesel engines. A small 25-hp. Sullivan electric hoist is being used for shaft sinking. When lateral work is started at 450 m., the company expects to encounter the extension of the high-grade sulphide ores of the adjoining Santa Maria de la Paz property.

■

Harmill to Build Concentrator

Construction of a 100-ton unit of a concentrating plant will be undertaken at the Ubehebe copper property of Harmill Milling & Smelting, in Owens Valley, Calif. Roads are now being prepared for hauling machinery to the property. The proposed flow sheet of the mill includes a Symons cone crusher, ball mill, Dorr classifier, Groch flotation machines, and a Dorr thickener. The property has been drilled over a length of 2,000 ft. and to a depth of 165 ft.

■

Colorado Meeting Successful

About three hundred mining men attended the joint annual convention of the Colorado Mining Association and the Colorado chapter of the American Mining Congress in Denver, Jan. 21-22. Among the questions discussed were Colorado's need for a centrally located smelter; safety; transfer of public lands to the states; the proposed 30c. tariff on silver; and the Norbeck bill on mineral rights in forest reserves.

Supply Bill Asks $2,549,480 for U. S. Bureau of Mines

Appropriation of $2,549,480 for the U. S. Bureau of Mines is carried in the annual supply bill, favorably reported from the House Committee on Appropriations Jan. 22. This represents an increase of $274,810 over the Bureau's appropriation for the current fiscal year, but after the funds for carrying out its helium program are deducted, the net increase is only $63,000. An increase of $16,640 is included in the fund of $438,640 for investigating mine accidents, $8,640 of which is for the employment of two associate engineers to undertake field studies and obtain data regarding actual performance under operating conditions of electrical equipment which has been approved by the Bureau for use in gassy coal mines. About $8,000 is required for the immediate replacement of the explosives-testing laboratory at the experimental mine at Bruceton, destroyed by explosion and fire. The fund of $165,000 for mining investigations represents an increase of $22,500, to provide for an increased number of temporary consultants and for additional full-time engineers in connection with the study of mining methods and costs.

For the U. S. Geological Survey, an increase of $150,000 has been voted by the House. As compared with last year's appropriation of $350,000, the present bill provides $400,000 for geological surveys and $100,000 for research work in geology. Under the proposed increase, the first step will be addition of several technical men as assistants to some of the geologists, thus providing the organization with properly trained specialists when the present heads of the departments retire.

■

Butte Miners Awarded Medals

Four Butte miners have been awarded silver medallions by Anaconda Copper for having saved a human life. The man whose life was saved is Oscar Lindberg, who was rendered unconscious by electric shock in the Belmont mine on Jan. 16. The men to whom awards have been made are Werne Lavia, Fred Reindl, Chester Judd, and Frank Shone.

■

Santa Elena to Build Mill

Construction of a 500-ton concentrator will be undertaken by Santa Elena Mining, at its property near Ojinaga, Chihuahua, Mexico. The ore carries lead, zinc, and copper. The cost of the new plant is put at about $250,000.

■

Start Virginia Manganese Mill

Operation of the new manganese-ore concentrator of Hy-Grade Manganese Production & Sales, at Woodstock, Va., was started late in January, after development had been carried on at the property for more than eight years. Capacity is 30,000 tons of ferro-grade manganese ore annually. This is the third large domestic manganese concentrator put in operation recently. Combined capacity of these plants is more than 200,000 tons of manganese annually.

CABLES

EXCLUSIVE TO "ENGINEERING AND MINING JOURNAL" AND "ENGINEERING AND MINING WORLD"
FROM CORRESPONDENTS IN THE PRINCIPAL MINING CENTERS

Huanuni Dredge Nearly Ready; Some Bolivian Tin Mines Close

La Paz, Bolivia, Jan. 27—The dredge installation at the Huanuni tin placers, near Uncia, is nearing completion. Ludlum Engineering, of New York, is equipping this area, which extends for nearly 10 miles along the Huanuni River. The dredge has a rated capacity of 120,000 cu.yd. monthly, estimates having placed the total developed reserves at 15,000,000 cu.yd., with an average content of 2½ lb. of tin oxide per cubic yard. Average width of the dredging area is 600 ft. and depth of the gravel about 30 ft.

. . . . Several of the smaller tin mines are preparing to shut down because of the low price of the metal. Among the properties that intend to close are Chojnacota, Colquecheca, Huanuni, Negro, and Pabellon. Of these, Huanuni is also an important producer of zinc concentrate, with high silver content. The low prices of all its three products have adversely affected profits of this company, which is controlled by Chilean interests and is in no way connected with the dredging enterprise mentioned above.

. . . . . Scheelite shipments from the Condeaqui district are being continued. A new concentrator is being constructed there.

■

R.C.B.C. Completes Two New Holes on N'Changa Extension

London, Jan. 31.—Drill holes Nos. N. E. 8 and 16 have been completed at the N'Changa West Extension property of Rhodesian Congo Border Concession, adjoining N'Changa Copper, in Northern Rhodesia. Drill holes Nos. N. E. 5, 6, and 7 were previously completed in the same area. The two new drill holes were put down about 2,000 ft. north of the three others, which had been drilled on an east-west line. The new strikes are estimated to have proved about 35,000,000 tons of 9 per cent copper ore within a small area in which no tonnage had previously been definitely outlined. Hole N. E. 8, for which assays are available, showed 73 ft. of ore, averaging 10.25 per cent copper, all sulphide.

. . . . Mill design for the new Mufulira concentrator, which will have the same capacity as the Roan plant, is well in hand and preliminary construction work is making progress. The first unit of the Mufulira power plant is nearly ready for an initial run.

. . . . The main shaft at Roan Antelope has reached 420 ft., which is the depth at which the first main haulage level will be established. About a two years' supply of ore for the 5,000-ton concentrator has been indicated above this level. The hoist for this shaft, which will be able to handle 5,000 tons in fourteen hours, has already been landed at the port of Beira. Equipment for the second unit of the Roan power plant is being installed and erection of the all-steel main concentrator building has started.

■

Opposition to Recruiting Labor Develops in Nyasaland

Johannesburg, Jan. 27 — Considerable opposition is developing among local planters and merchants in Nyasaland to recruiting of colored workers from the territory for mines on the Witwatersrand and Northern Rhodesia. The Havelock asbestos mine, in Swaziland, which has been acquired by Turner & Newall for £250,000, will be equipped on a large scale and may become the world's most important asbestos producer.

. . . . Contract has been placed for the permanent power plant at Bwana M'Kubwa's N'Kana mine. International Combustion Company will furnish the boilers for the plant and Metropolitan Vickers will supply the electrical equipment. N'Kana's initial operations will be on the basis of 5,000 tons of ore daily from the N'Kana and Mimbula orebodies.

. . . . A new metallurgical process has been developed for the treatment of gold-antimony ores on the Murchison range, in northern Transvaal, and prospects for properties in that district have been considerably bettered. In 1929, according to compilations just completed, the twelve leading mines on the Witwatersrand produced nearly one third of the world's entire gold output. All Transvaal mines combined produced 10,414,066 oz., compared with 10,358,596 oz. in 1928.

■

Disputada Starts New Mill Unit; Chilean President Signs Code

Santiago, Chile, Jan. 25 — Disputada Mining, in the Las Condes district, started the new 150-ton section of its mill, bringing total mill capacity up to 500 tons daily, on Jan. 20. The Caja de Credito Minero has conceded a loan of 1,200,000 Chilean pesos to the Carlota Mining Company, at Maipo, 80 kilometers from Santiago, to build a ropeway to the river and buy mining equipment. Development of the mine will be undertaken with the object of proving sufficient tonnage to construct a 200-ton mill. Additional funds will be advanced if needed for mill construction.

. . . . The President of Chile signed the new mining law on Jan. 23. Experts consider this legislation far superior to the old code.

Golden Horseshoe Tailing Plant Ready to Start Operations

Kalgoorlie, Western Australia, Jan. 24.—The new plant for re-treatment of tailing on the Golden Horseshoe dump has been completed and is ready to start operations at the end of this month. Its capacity will be 40,000 tons of tailing monthly, and enough material for five years' operation is contained in the dump. The tailing assays about 8s. a ton. The plant cost about £35,000 to build.

. . . . South Kalgurli Consolidated will sink the shaft on the Croesus property, which it has leased, an additional 150 ft. to a depth of 1,200 ft. Mechanical scrapers have been installed underground at the Croesus property for the purpose of filling stopes. They are the first installations of the kind in the Kalgoorlie district.

. . . . Development of the Enterprise Gold property has disclosed an important orebody. On the 504 level, a crosscut showed 33 ft. in width.

■

Malayan Dredges Curtailing; Government Aid for Wiluna

Melbourne, Jan. 27—In the Federated Malay States, 69 of the 105 tin dredges operating have agreed to stop work on week-ends, the agreement taking effect for the first time on Jan. 18. Operations were suspended at 10 o'clock on Saturday morning and were resumed at 6 o'clock Monday morning. The proposal has also been made that operations be completely suspended for one week.

. . . . Wiluna Gold, the Western Australian enterprise near Meekatharra, has been advanced £300,000 by the provincial government to bring the mine into production. A total of 328 men is now employed at the property, and the main shaft has reached a depth of 600 ft.

. . . . A British Columbia subsidiary will soon be incorporated by Placer Development, according to announcement, to take over operation of the company's gold-dredging area on the Bulolo River, in New Guinea. Two large electric dredges will be placed in operation on the 1,100 acres of alluvial ground the company holds. Twelve years of life for these dredges, which will have a combined capacity of 3,000,000 cu.yd. annually, has been proved. The new company will have capital of $4,000,000.

. . . . The alluvial area of tantalite at Mount Finnis, in North Australia, has been proved for an extent of 60 acres. The average depth is 2 ft., and the available dirt is estimated at 8,176,-

000 cu.yd., containing 790 tons of tantalite. An English trust company has taken an option on a large undeveloped gold property at Stawell, Queensland, on which the strike of the vein is said to have been proved for approximately half a mile.

. . . . Electrolytic Zinc produced 4,251 tons of zinc in the four weeks ended Jan. 8, which sets a new record for the plant at Risdon, Tasmania. The previous record was 4,212 tons, set the four weeks ended Dec. 11. Capacity is now being increased to about 67,000 tons annually.

■

German Metal Imports Down; New Zinc Cartel Unlikely

Berlin, Jan. 31.—Official import figures for the year 1929 have been released. Imports of refined copper amounted to 194,630 metric tons, compared with 226,983 in 1928. The value is put at 323,000,000 marks, compared with 308,000,000 marks in 1928. Lead imports were 136,813 metric tons, against 148,538 tons in 1928, and zinc imports were 136,207 tons, against 143,233 tons in 1928. Production of lead in 1929 is put at 111,000 tons, against 104,900 tons in 1928, and corresponding figures for zinc production are 105,323, against 103,357.

. . . . Business conditions here are still depressed, but apparently they are beginning to turn the corner. The question of duties on aluminum is still being considered, but they will probably be put into effect soon. Concern persists over possible competition from Anaconda, the Guggenheim interests, and Phelps Dodge in manufactured copper products for the world market because of the slow sales in the United States. German copper stocks are small, but demand should revive suddenly when the credit volume is amplified.

. . . . Outlook for a renewal of the Brussels zinc cartel, which has been officially disbanded, is deemed unfavorable because of the new nitrogen projects under way in Europe. These necessitate a large supply of sulphuric acid from zinc-ore roasting.

■

Berenguela to Sink Shafts

La Paz, Bolivia, Feb. 3.—Berenguela Tin Mines is issuing notes to provide for the development by shafts of its deposits on the San Bartolome, Candelaria, and Colon Coya properties, at Berenguela. The company produces about 350 tons of 60 per cent tin concentrate annually from ore averaging about 2 per cent tin. The present issued capital is 300,000 4s. shares, on which dividends have been paid irregularly, the last recorded being in 1927 and amounting to 5 per cent.

. . . . Naming of Simon I. Patiño as honorary president of the British Tin Producers' Association has encouraged tin operators here, as it indicates that his important interests will undertake curtailment.

London Metal Sales Small; Chinese Not Yet in Tin Cartel

London, Feb. 1—Trade here not being good, business in metals continues depressed and prices are low. The general condition of the metal market is given as the reason for the recent formation of Amalgamated Metals Corporation, Ltd., which intends to substitute cooperation for competition. Amalgamated Metals is the holding company, with a capital of £5,000,000, that will acquire the Henry Gardner and British Metal interests. The attempts that are being made to maintain metal prices are not very successful, because of the large stocks and small demand. The feeling is that copper, lead, zinc, and tin are all overproduced. The Belgians are still trying to arrange a new zinc cartel, but nothing has yet come of their efforts.

. . . . Tin prospects appear more hopeful, as Patiño and Aramayo have agreed to restrict output from their properties in Bolivia. The Aramayo interim dividend has been suspended, but development work is being increased. Simon I. Patiño has become the honorary president of the Tin Producers' Association. He has nominated two members to represent his interests on the committee. All large Bolivian producers, representing more than 80 per cent of the country's output, are now supporting the policy of the association. This organization is now awaiting action from the Chinese producers, who have hitherto shown no sign of agreement. General opinion here is that no scheme for tin curtailment will be effective unless every important factor in the industry is in agreement. The present restriction amounts to about 10,000 to 12,000 tons of tin a year, or less than 10 per cent of the annual production.

. . . . Société Générale de l'Etain is the company formed to prospect for tin in Katanga, Belgian Congo. About 60 per cent of the capital for this enterprise has been subscribed by Union Minière, Geomines, Simkat, and Minerkat.

. . . . Duncan Alves and Hugh Marriott, of the technical staff of the Panama Corporation, which holds large concessions on non-ferrous metal properties in Panama, are sailing for New York, possibly to interest American capital in this enterprise.

English noteholders and German creditors of Lena Goldfields are appealing to Moscow to obtain satisfaction of their claims against the company, which holds concessions on Russian mines and which failed recently.

■ ■ ■

British Columbia Mines Close as Brokers Are Arrested

The Kootenay Florence, Slocan Rambler, Yankee Girl, Lorne, and Utica mines, in eastern British Columbia, have been closed because of the arrest of the heads of Stobie, Forlong & Company, in Toronto, on Jan. 30. Investigation into the practices of Canadian mining brokers has resulted in numerous arrests. Stobie, Forlong had about $500,000 invested in the properties mentioned. Other companies affected by the investigation are Solloway, Mills & Company, A. E. Moysey & Company, Homer L. Gibson & Company, and D. S. Patterson & Company. Thirteen men have been arrested and are out on bail of $100,000 each. All books, securities, and cash have been seized by officers, and the firms have been suspended from trading on the Toronto mining exchange. The five companies were generally understood to have more or less controlled brokerage operations on the exchange through utilization of other brokers as agents. In general, the sentiment in mining circles favors the action of the government. Mining men have felt that grave abuses existed and, although some check is expected in promotion of mining enterprises, no real damage to the mining industry is anticipated.

■

Howey Mill to Start Soon

Power was turned on at Howey Gold, in the Red Lake district, Ontario, at the end of January and operations of the 500-ton concentrator are expected to start within two weeks. The mill building has been completed and facilities have been provided to handle the tonnage. At the start only 250 tons will be handled daily. Power for the plant comes from the Ear Falls development of the Ontario power commission, delivered over a 44-mile transmission line. Power will be delivered for $35 per horsepower-year.

■

Rawley Repairs Tramway

Repairing of the cable tramway at the Rawley mine, near Bonanza, Colo., has been completed and production is now on a normal basis of 350 tons of lead-copper ore daily. Storms in the district caused the failure of one of the tramway towers in mid-January, and the mill had to be closed down for about two weeks.

■

Nevada Tungsten Plant Ready

Installation of transformers at the 75-ton tungsten concentrator of Massachusetts-Nevada, near Sodaville, Nev., was completed on Feb. 1. A 6½-mile power line had been built to the plant. As soon as the cable tramway connecting mine and mill has been completed, production will be started from the property.

■

Gold Hill Completing Raise

A raise to the surface from the 225 level of the Gold Hill Development property, at Round Mountain, Nev., has been put up 165 ft. in ore. This outlet will be used chiefly for ventilation when completed. Drifting has shown 870 ft. of mill-grade ore on the 225 level of this property, with widths varying from 2 to 15 ft. The east face is still in ore. Drifting is also in progress of the 400 level, with 410 ft. of ore indicated.

MARKET AND FINANCIAL NEWS

Good Demand for Copper from Domestic and Foreign Consumers

New York, Feb. 5, 1930.—Improvement in the demand for copper was more marked in the last three weeks than earlier in the year. Sales of copper to domestic consumers for the week ended Feb. 5 were the largest in any week since the middle of last September. All of the business was placed on the basis of 18c., delivered in the East. Activity in lead was well up to the high level established around the turn of the year. Zinc developed further weakness, establishing a new low for the movement. Some progress was made in connection with regulating production of tin, but this was not reflected in the price structure. On Feb. 4, silver dropped to 43⅛c., New York, a new all-time low.

Better Call for Copper

Late in January and in the first week in February fabricators came into the market for a good tonnage of copper. Domestic sales for the week ended Feb. 5 approximated 11,000 tons, the total being somewhat above the average weekly sales for the year 1929. Wire, cable, and brass mills were the principal buyers. Shipping instructions for most of the copper purchased called for immediate or prompt shipment, indicating that reserves in the hands of fabricators were permitted to run down to an extremely low point. Business in finished products has been improving steadily for several weeks and confidence in the future is gradually being restored. Export business in copper also has increased, sales for the first five days of February amounting to about 5,000 tons. Export sales for the month of January totaled 33,500 long tons, which was well above the average for the three preceding months. Copper Exporters' continued to quote 18.30c., c.i.f. European ports.

Silver Makes New Low

Offerings of so-called government silver resulted in depressing the market, and on Feb. 4 the New York quotation fell to 43⅛c., a new low. Demand for silver from China was disappointing.

Lead Demand Satisfactory

Consumption of lead continues at a high level. January was an excellent month, total sales of all producers averaging a little over 2,200 tons a day, compared with less than 2,100 tons for January, 1929. Sales in the first week in February were sufficient in volume to point to another satisfactory month's business. All of the leading consuming interests have been well represented in the orders recently placed. Domestic prices were firm at 6.25c., New York, the A. S. & R. contract basis, and 6.10c., St. Louis. Corroding grades command the usual premiums of $2 to $3 per ton.

Zinc Prices Unsettled

Selling pressure in zinc, which developed during the week ended Jan. 22, sent the price down to 5c., St. Louis. That week witnessed a heavy volume of business, the total tonnage moved during the period being in excess of 10,000 tons. Consumers were anxious to take on zinc for delivery over the first half of the year, but most sellers were not inclined to offer the metal at current levels beyond March. Prices recovered somewhat toward the close and settled at 5.25c., near-by positions. Stocks of zinc in the United States on Feb. 1 were 87,933 tons, against 77,262 tons a month previous.

Little Change in Tin

Curtailment in production is expected to steady prices for tin, but so far the market has not responded to the news regarding stabilization of the industry. Prices have held around 39c. for Straits tin, with some good buying by consumers whenever the market went under this level.

■

Premium Price Restored in Tri-State District

Joplin, Mo., Feb. 1, 1930.

Blende	Per Ton
High	$37.20
Premium blende, basis 60%	37.00
Prime Western, 60%	35.00
Table concentrate, 60%	34.00
Flotation concentrate	33.50
Average settling price	34.91
Galena	
High	$76.40
Basis 80%	75.00
Average settling price	76.27

The Allen Sales Agency was successful in establishing a premium price for concentrate to be converted into high-grade zinc oxide and for metal suitable for zinc strips. The $2 differential, according to reports, is to be maintained permanently.

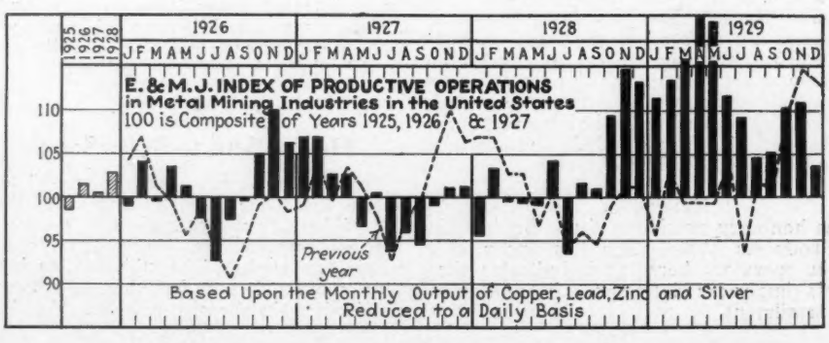
■

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c. London, 98 per cent, quoted at £95 per long ton, less 2 per cent for domestic consumption.

ANTIMONY—Per lb., duty paid: Chinese brands, spot, 8¼c.; futures, 8@8⅛c. Cookson's "C" grade, spot, 14c. Chinese needle, lump, 8c. Standard powdered needle, 200 mesh, 10c.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E. & M. J. INDEX OF PRODUCTIVE OPERATIONS
in Metal Mining Industries in the United States
100 is Composite of Years 1925, 1926 & 1927
110
105
100
95
90
Previous year
Based Upon the Monthly Output of Copper, Lead, Zinc and Silver
Reduced to a Daily Basis

Daily Prices of Metals

January / February	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
16	17.775	38.875	6.25	6.10	5.10
17	17.775	38.50	6.25	6.10	5.00
18	17.775	38.375	6.25	6.10	5.10
20	17.775	38.375	6.25	6.10	5.10@5.15
21	17.775	37.875	6.25	6.10	5.15
22	17.775	38.25	6.25	6.10	5.15
Average...	17.775	38.375	6.250	6.100	5.104
23	17.775	38.25	6.25	6.10	5.20@5.25
24	17.775	38.375	6.25	6.10	5.225
25	17.775	38.375	6.25	6.10	5.225
27	17.775	38.625	6.25	6.10	5.25@5.275
28	17.775	39.50	6.25	6.10	5.25@5.30
29	17.775	39.75	6.25	6.10	5.25@5.30
Average...	17.775	38.813	6.250	6.100	5.248
30	17.775	39.375	6.25	6.10	5.25
31	17.775	39.125	6.25	6.10	5.25
1	17.775	39.00	6.25	6.10	5.25
3	17.775	38.875	6.25	6.10	5.25
4	17.775	39.125	6.25	6.10	5.25
5	17.775	38.75	6.25	6.10	5.25
Average...	17.775	39.042	6.250	6.100	5.250

Average prices for calendar week ended January 18, 1930, are: Copper, 17.775c.; Straits tin, 38.688c.; New York lead, 6.250.; St. Louis lead, 6.100c.; zinc, 5.117c.; and silver, 45.729c.

Average prices for calendar week ended January 25, 1930, are: Copper, 17.775c.; Straits tin, 38.250c.; New York lead, 6.250c.; St. Louis lead, 6.100c.; zinc, 5.183c.; and silver, 44.813c.

Average prices for calendar week ended February 1, 1930, are: Copper, 17.775c.; Straits tin, 39.229c.; New York lead, 6.250c.; St. Louis lead, 6.100c.; zinc, 5.260c.; and silver, 43.938c.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

London

Jan. / Feb.	Copper		Electrolytic	Tin		Lead		Zinc	
	Standard								
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
16	70¾	68⅞	83¼	176½	179½	21½	21½	19⅜	20
17	71⅛	68⅝	83¼	174⅛	177¼	21½	21 9/16	19⅜	20
20	72⅛	68½	83¼	173¾	176¾	21½	21 9/16	19 7/16	20 1/16
21	71⅞	68⅝	83¼	172¼	175¼	21½	21 9/16	19⅜	20¼
22	71⅞	68½	83¼	170⅞	174	21 9/16	21 9/16	19 11/16	20 5/16
23	71½	68½	83¼	172	175¼	21⅝	21⅝	19¾	20⅜
24	71½	68⅛	83¼	172½	175⅝	21 9/16	21 9/16	19 13/16	20 7/16
27	71½	68⅛	83¼	174½	177⅜	21⅝	21⅝	19⅞	20⅜
28	71½	68 7/16	83¼	176⅜	179½	21 9/16	21 9/16	19 13/16	20 5/16
29	71 13/16	68½	83½	180½	183¾	21 9/16	21 9/16	20 1/16	20½
30	72	68⅜	83½	178	181¼	21 11/16	21⅝	20 1/16	20½
31	71⅞	68⅜	83½	176⅛	179⅛	21⅝	21 9/16	19 15/16	20½
3	72⅜	69	83½	174⅞	177⅞	21⅝	21⅝	19 15/16	20 7/16
4	72¾	69	83½	176⅜	179¾	21 9/16	21⅝	19⅝	20 5/16
5	72⅞	69¼	83½	176⅛	179⅞	21½	21 9/16	19 9/16	20¼

Prices for lead and zinc are the official prices for the morning session of the London Metal Exchange; prices for copper and tin are the official closing buyers' prices. All are in pounds sterling per long ton (2,240 lb.).

Silver, Gold, and Sterling Exchange

Jan.	Sterling Exchange "Checks"	Silver		Gold London	Jan. / Feb.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
16	$4.86 7/16	46	21 7/16	84s11⅜d	27	$4.85 15/16	44⅜	20⅝	84s10¾d
17	4.86 5/16	45	21	84s11⅜d	28	4.86 1/16	44½	20⅝	84s11¼d
18	4.86¼	45¼	20 15/16	.....	29	4.86	44¼	20 9/16	84s11½d
20	4.86⅜	45⅜	21 1/16	84s11⅜d	30	4.86⅛	43⅞	20⅝	84s11½d
21	4.86¼	45¼	21	84s11d	31	4.86 3/16	43¼	20	84s11½d
22	4.86 3/16	44⅞	20 15/16	84s11⅜d	1	4.86	43½	20⅛	.....
23	4.86 3/16	44⅞	20 15/16	84s10 d	3	4.85⅞	43⅜	20 1/16	84s11¼d
24	4.86 3/16	44¼	20 9/16	84s10½d	4	4.85 13/16	43½	19 15/16	84s10⅞d
25	4.86¼	44½	20 11/16	.....	5	4.86	43⅜	20	84s11 d

Average for week ended Jan. 22: Silver, 45.292c.; Sterling Exchange, $4.863.
Average for week ended Jan. 29: Silver, 44.417c.; Sterling Exchange, $4.861.
Average for week ended Feb. 5: Silver 43.438c.; Sterling Exchange, $4.860.

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of silver, 999 fine. London silver quotations are in pence per troy ounce of bar silver, basis of 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

BISMUTH—Per lb., in ton lots, $1.70. London 7s. 6d.

CADMIUM—Per lb., 80@90c. London, 3s.11d.@4s. for prompt.

CHROMIUM—Per lb., 97@98 per cent grade, 95c.@$1.

COBALT—Per lb., f.o.b. Canadian works: Shot or rondelles, 97@98 per cent, $2.50. Contract sales booked at discounts, depending on quantity. Black oxide, 70 per cent, $2.10. London, nominal, 10s. for metal in small lots, 8s. for black oxide; 8s. 10d. for gray.

GERMANIUM DIOXIDE—Per gram in 200- to 300-gram lots, $3.50.

IRIDIUM—Per oz., $185@$195 for 98 @99 per cent sponge and powder. London, £39@£42.

LITHIUM—Per oz., 98@99 per cent grade in 2- to 6-lb. lots, $6.

MAGNESIUM—Per lb., single orders for spot metal: 8-lb. ingots (3x3x15 or 16 in.), 95c.@$1.05, depending on quantity; 2½- or 3-lb. sticks (1⅛ in.) 90c.@$1.10, depending on quantity; 10-oz. sticks (1x12 in.), 80c.@90c. Discounts up to 20 per cent on larger orders or contracts. London 3s. 3d.@ 3s. 6d. for 99 per cent ingots or sticks.

MOLYBDENUM—Per lb. in 50- to 100-lb. lots, 99 per cent, $11. (Usually sold as calcium molybdate or ferromolybdenum.)

NICKEL—Per lb., ingot, 35c.; shot, 36c.; electrolytic, 35c. (99.90 per cent), for single lots of spot metal. London, per long ton, £170@£175.

OSMIUM—Per oz., $70, nominal. London, £13 15s.

PALLADIUM—Per oz., $34@$35; London, £6 10s.@£7.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $61. Transactions between dealers and refiners in the outside market are commonly reported at several dollars less. London, per oz., £12 10s.@£13 for refined; crude and scrap, £11@£11 15s.

QUICKSILVER—Per 76-lb. flask, $120 @$121. Market continues quiet and prices on round lots are nominal. London quiet at £23@£23 5s.

RADIUM—Per mg. radium content, $70.

RHODIUM—Per oz., $45@$50. Nominal. London, £11@£12.

RUTHENIUM — Per oz., $40@$45. Nominal. London, £9.

SELENIUM—Per lb. in 500-lb. lots: Black, powdered, amorphous, 99.5 per cent pure, $2. London, 7s. 8d.@ 7s. 9d.

TANTALUM — Per gram: Bar and heavy sheet, chemically pure, 16c.; tantalum powder, 11c.

TELLURIUM—Per oz., 15@18c.

THALLIUM METAL—$12.50@$15 per pound.

TITANIUM—Per lb., 80@90 per cent grade, $5.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York		London Spot		Sterling Exchange	
	1929	1930	1929	1930	1929	1930
January	57.019	45.000	26.257	20.896	484.577	$4.864
February	56.210	.....	25.904	.....	484.787	.....
March	56.346	.....	26.000	.....	484.776	.....
April	55.668	.....	25.738	.....	484.808	.....
May	54.125	.....	25.084	.....	484.599	.....
June	52.415	.....	24.258	.....	484.330	.....
July	52.510	.....	24.289	.....	484.560	.....
August	52.579	.....	24.288	.....	484.368	.....
September	51.042	.....	23.708	.....	484.253	.....
October	49.913	.....	23.042	.....	486.392	.....
November	49.615	.....	22 690	.....	487.104	.....
December	48.475	.....	22.258	.....	487.523	.....
Year	52.993	.....	24.460	.....	485.173	.....

New York quotations, cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York		London Spot			
	Electrolytic		Standard		Electrolytic	
	1929	1930	1929	1930	1929	1930
January	16.603	17.775	75.551	71.469	78.602	83.250
February	17.727	.....	78.228	.....	83.538	.....
March	21.257	.....	89.153	.....	98.356	.....
April	19.500	.....	81.036	.....	89.405	.....
May	17.775	.....	75.026	.....	83.727	.....
June	17.775	.....	74.338	.....	84.013	.....
July	17.775	.....	72.152	.....	84.043	.....
August	17.775	.....	73.783	.....	84.250	.....
September	17.775	.....	75.286	.....	84.363	.....
October	17.775	.....	72 815	.....	83.978	.....
November	17.775	.....	69.324	.....	82.202	.....
December	17.775	.....	68.303	.....	82.569	.....
Year	18.107	.....	75.416	.....	84.921	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London			
	1929	1930	1929	1930	1929 Spot	1929 3 Mos.	1930 Spot	1930 3 Mos.
January	6.650	6.250	6.498	6.100	22.111	22.344	21.545	21.571
February	6.853	.....	6.739	.....	23.128	23.156	.....	.....
March	7.450	.....	7.348	.....	25.409	25.591	.....	.....
April	7.187	.....	7.025	.....	24.783	24.408	.....	.....
May	7.000	.....	6.761	.....	23.949	23.750	.....	.....
June	7.000	.....	6.790	.....	23.694	23.603	.....	.....
July	6.804	.....	6.607	.....	22.810	22.880	.....	.....
August	6.750	.....	6.553	.....	23.185	23.259	.....	.....
September	6 890	.....	6.689	.....	23.557	23.589	.....	.....
October	6 873	.....	6.674	.....	23.226	23.253	.....	.....
November	6.285	.....	6.135	.....	21.622	21.643	.....	.....
December	6.250	.....	6.100	.....	21.472	21.484	.....	.....
Year	6.833	.....	6.660	.....	23.246	23.247	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Tin

	New York		London	
	1929	1930	1929	1930
	Straits		Spot	
January	49.139	38.851	222.727	175.460
February	49.347	.....	223.138	.....
March	48.870	.....	220.781	.....
April	45.858	.....	206.887	.....
May	43.904	.....	197.545	.....
June	44.240	.....	200.206	.....
July	46.281	.....	209.473	.....
August	46.619	.....	209.815	.....
September	45.359	.....	204.863	.....
October	42.290	.....	190.783	.....
November	40.208	.....	180.565	.....
December	39.745	.....	179.419	.....
Year	45.155	.....	203.850	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Zinc

	St. Louis		London			
	1929	1930	1929 Spot	1929 3 Mos.	1930 Spot	1930 3 Mos.
January	6.350	5.229	26.196	26.233	19.634	20.241
February	6.350	.....	26.247	26.347	.....	.....
March	6.463	.....	27.050	27.294	.....	.....
April	6.658	.....	26.759	26.613	.....	.....
May	6.618	.....	26.727	26.619	.....	.....
June	6.686	.....	26.216	25.984	.....	.....
July	6.766	.....	25.332	25.418	.....	.....
August	6.800	.....	24.896	25.164	.....	.....
September	6.799	.....	24.208	24.688	.....	.....
October	6.740	.....	22.927	23.329	.....	.....
November	6.242	.....	20.851	21.351	.....	.....
December	5.666	.....	20.072	20.672	.....	.....
Year	6.512	.....	24.790	24.976	.....	.....

St. Louis quotations, cents per pound. London pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) Refined New York		Platinum (c) Crude New York	
	1929	1930	1929	1930	1929	1930	1929	1930
Jan	9.558	8.606	119.481	121.192	70.000	61.923	60.000	51.92
Feb	9.548	.....	119.818	.....	70.000	.....	60.000	.....
March	9.531	.....	121.904	.....	70.000	.....	60.000	.....
April	9.462	.....	122.000	.....	70.000	.....	60.000	.....
May	8.957	.....	121.154	.....	68.615	.....	58.615	.....
June	8.845	.....	120.500	.....	68.000	.....	58.000	.....
July	8.543	.....	121.654	.....	68.000	.....	58.000	.....
Aug	8.778	.....	125.111	.....	68.000	.....	58.000	.....
Sept	8 709	.....	124.542	.....	66.000	.....	56.000	.....
Oct	8.538	.....	124.298	.....	65.000	.....	55.000	.....
Nov	8.583	.....	123.323	.....	65.000	.....	55.000	.....
Dec	8.420	.....	121.950	.....	63.240	.....	53.240	.....
Year	8.956	.....	122.145	.....	67.655	.....	57.655	.....

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. (c) Platinum in dollars per ounce.

Pig Iron[1] and Aluminum

	Bessemer		Basic		No. 2 Foundry		Aluminum	
	1929	1930	1929	1930	1929	1930	1929	1930
Jan	18.00	.....	17.50	.....	17.50	.....	24.300	24.300
Feb	18.00	.....	17.50	.....	17.50	.....	24.300	.....
March	18.19	.....	17.62	.....	17.69	.....	24.300	.....
April	18.50	.....	18.00	.....	18.00	.....	24.300	.....
May	18.81	.....	18.31	.....	18.31	.....	24.300	.....
June	19.00	.....	18.50	.....	18.50	.....	24.300	.....
July	19.00	.....	18.50	.....	18.50	.....	24.300	.....
Aug	19.00	.....	18.50	.....	18.50	.....	24.300	.....
Sept	19.00	.....	18.50	.....	18.50	.....	24.300	.....
Oct	19.00	.....	18.50	.....	18.50	.....	24.300	.....
Nov	19.00	.....	18.50	.....	18.50	.....	24.300	.....
Dec	19.00	.....	18.50	.....	18.50	.....	24.300	.....
Year	18.71	.....	18.20	.....	18.21	.....	24.300	.....

Iron in dollars per long ton. Aluminum in cents per pound, 99 per cent grade.

[1]F.o.b. Mahoning and Shenango valley furnaces; freight to Pittsburgh, $1.76.

Monthly Crude Copper Output in Short Tons

Domestic

	1929 June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Alaska shipments	1,793	1,514	893	3,282	1,203	2,079	2,275
Calumet & Arizona	5,286	4,986	5,262	4,926	5,206	4,981	5,132
Magma	1,664	1,616	1,585	1,729	1,660	1,338	1,377
Miami	2,416	1,763	2,317	2,186	3,350	2,882	2,609
Nevada Con	†36,309	.....	.....	†30,095	.....	.....	.....
Old Dominion*	782	898	954	932	1,003	1,041	830
Phelps Dodge††	8,901	9,274	9,144	9,126	8,534	7,849	8,20 0
United Verde Extens	2,510	2,235	2,296	2,570	3,019	2,388	2,37 1
Utah Copper	†42,310	.....	.....	.....	.....	.....	.....
Tennessee Copper	638	677	659	660	678	710	705

Foreign

Andes Copper	6,871	7,445	6,625	6,538	6,537	5,627	.....
Braden	7,630	7,620	7,628	7,656	7,523	6,768	.....
Boleo, Mexico	†3,637	.....	.....	†3,107	.....	.....	†3,542
Bwana M'Kubwa	536	561	593	541	665	459	598
Chile	12,060	11,044	10,884	10,877	10,873	8,746	.....
Furukawa, Japan	1,506	1,260	1,425	1,513	1,439	1,478	.....
Granby Cons., Canada	2,518	2,467	2,510	2,718	2,666	2,525	2,345
Howe Sound	†5,452	.....	.....	†5,361	.....	.....	.....
Messina	654	667	657	557	590	519	588
Mt. Lyell	548	600	800	815	790	773	624
Sumitomo, Japan	.....	.....	1,532	1,352	†1,785	.....	.....
Union Miniere, Africa	12,673	13,216	13,444	14,106	13,995	.....	.....

†Three months. *Includes Arizona Commercial.
††Moctezuma is included.

Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

	1927 Monthly Production	1927 Daily Rate	1928 Monthly Production	1928 Daily Rate	1929 Monthly Production	1929 Daily Rate
January	76,198	2,458	68,469	2,209	86,325	2,785
February	69,202	2,472	67,423	2,352	84,735	3,026
March	69,314	2,236	70,327	2,269	93,698	3,023
April	71,122	2,371	69,721	2,324	94,902	3,163
May	71,613	2,310	73,729	2,378	93,392	3,013
June	69,539	2,318	73,224	2,441	82,354	2,745
July	65,545	2,114	73,426	2,369	79,229	2,556
August	67,248	2,169	76,952	2,482	78,885	2,545
September	65,936	2,198	78,341	2,611	79,402	2,647
October	68,545	2,225	86,480	2,790	82,575	2,664
November	68,080	2,269	85,382	2,846	75,934	2,531
December	67,377	2,173	85,677	2,764	74,106	2,391
Total	829,978	.....	909,051	.....	1,005,537	.....
Monthly average	69,165	.....	75,754	.....	83,975	.....
Average of daily rate	.....	2,274	.....	2,484	.....	2,755